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# Journal of the Society of Arts.

FRIDAY, DECEMBER 4, 1857.

## SPECIAL GENERAL MEETING.

TUESDAY, DECEMBER 1st, 1857.

A Special General Meeting of the Society, was held on Tuesday evening, the 1st inst., at seven o'clock.

Mr. C. WENTWORTH DILKE, chairman of the Council, said, that it appeared to his colleagues and himself, that it would be more becoming on this occasion, when undoubtedly the conduct of some of the Members of Council might be considered to be under discussion, to place in the chair some member unconnected with either side. He should, therefore, before he sat down, propose a gentleman whose name would, he believed, be satisfactory to all. Mr. Dilke said he had been instructed by the Council to have before him the Minutes of Meetings of Council, and of the Board of Examiners and other Committees, in case the chairman or any gentleman might wish to have them referred to. The Council had also invited the representatives of the Press to be present. Mr. Dilke then proposed that Mr. W. H. Bodkin should take the chair.

This motion, having been seconded by Mr. MATTHEW MARSHALL, was carried unanimously.

Mr. BODKIN, having taken the chair, said, it appeared to those who felt it to be their duty to call the meeting that it was desirable the chair should be occupied by one who had taken no part whatever in the discussions which led to the meeting. Being an old member of the Society, and feeling desirous to be serviceable to it, he hoped this circumstance would acquit him of what, under other circumstances, might appear presumption. He should endeavour to perform his duty impartially, and if it was a recommendation that he knew nothing of the subject to be discussed beyond what he learned from a hasty perusal of the papers, he possessed that recommendation. He trusted that the discussion would be conducted in a conciliatory spirit, and in a manner in keeping with the character of the Society.

The SECRETARY read the Bye-laws relating to General Meetings of the Society, and those relating to the alteration of Bye-laws, as well as the following advertisement, inserted in the Society's *Journal* and in the newspapers, convening the meeting.

### "SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE.

"The Council hereby convene a Special General Meeting of the Members of this Society, to be held on Tuesday, the 1st of Dec., at 7 o'clock, p.m., for the following purposes:—

"1. To revoke the five existing Bye-laws which relate to the Board of Examiners, and to make and adopt other Bye-laws in the place thereof.

"2. To consider the amended and extended scheme of Examinations which the Council propose to carry out in concert with the Institutions in Union.

"3. In compliance with a requisition received from certain members, to take into consideration and decide on the propriety of continuing to hold Local Examinations of the Members of Mechanics' Institutions, and similar societies, and to award certificates of merit accordingly."

"4. And, generally, to pass such resolutions as may express the sense of the Meeting in relation to all or any of the before-mentioned subjects.

"By order of the Council,

"P. LE NEVE FOSTER, Secretary.

"Society's House, Adelphi, London, Nov. 23, 1857."

The SECRETARY produced the notice of the meeting, which, together with a copy of the proposed new Bye-laws,

had been suspended in the Society's room for the required period.

The SECRETARY then read the following report from the Council:—

"The Council consider that it will conduce to the convenience of members to give a brief summary of the points which they have proposed should be brought before the present Special General Meeting.

"The first subject is the legality of the present Bye-laws affecting the Examinations.

"Members will bear in mind that these Bye-laws are new, having been passed as recently as last February; and, during the past month of November, were, for the first time, about to come into operation. The attention of the Council was drawn to the fact, that the Bye-laws were contradictory to the Charter—that they were illegal. That they are illegal, the solicitor of the Society, who is now present, will assure the members if they entertain any doubts upon the subject.

"The Council submit to the members the expediency of passing new Bye-laws. The proposed new Bye-laws simply place the Board of Examiners under the control of the Council, as they were before the Bye-laws attempted to remove them from that control.

"The Council repudiate altogether the slightest intention of disrespect to the Examiners, in suspending their functions in order to prevent an election of them contrary to the Charter.

"The Council place, with confidence, their Programme of Examinations before the members at large."

Mr. EDWARD BAINES said, as president of the Yorkshire Union of Mechanics' Institutions, he had consented to take charge of some memorials which it was now his duty to present. He felt called upon to state that, a report having reached the Institutions which he represented, that the Society contemplated discontinuing the Examinations, a form of petition was agreed upon and sent round to the various Institutions of the Yorkshire Union. He felt necessary to take up the time of the meeting in reading this memorial, though he was sorry to say it was agreed to before they were acquainted with all the facts of the case, and he wished the meeting to know the exact truth as to the circumstances under which this memorial had been signed. Mr. Baines then proceeded to read the following memorial:—

### "TO THE SOCIETY FOR THE ENCOURAGEMENT OF ARTS, MANUFACTURES, AND COMMERCE.

"We, the undersigned members of Mechanics' Institutes comprised in the Yorkshire Union, have heard with feelings of deep regret that the Council of your Society have resolved to discontinue the Examinations, and thereby to deprive them of that stimulus to application in class instruction which they had reason to believe would have been continued from year to year; and they were fortified in this opinion from the success which has already been achieved, and which must have fully realised the most sanguine anticipations of all who have taken part in this important movement. Your memorialists are of opinion that no step which has yet been taken to influence the extension of mental cultivation, by means of Mechanics' Institutions, has been so practically beneficial as the stimulus afforded by the Local Examinations of the Society of Arts, and they entertain the most confident belief that the advantage to be gained in the future will be greater than has yet been accomplished, if the examinations be continued, and their usefulness extended by increasing the number of local centres. Your memorialists, therefore, beg respectfully but urgently to entreat that the good work thus auspiciously begun may be continued, and that from year to year they may enjoy the solid advantage of an examination in which the merits of the respective candidates are efficiently tested, and the only practical stimulus given to instruction in the Evening Classes of the several Institutions."

The memorial was signed as follows:—Ackworth Me-

chanics' Institute, 26; Almondbury, 64; Batley, 142; Barnoldswick, 37; Barnsley, 28; Bingley, 58; Brighouse, 81; Boston Spa, 10; Calverley, 44; Churwell, 57; Dewsbury, 57; Dogley Lane, 32; Doncaster, 156; Ecclehill, 36; Gomercal, 144; Halifax, 77; Headingley, 20; Hebden Bridge, 76; Helmsley, 22; Hepworth, 23; Holbeck, 41; Honley, 62; Hunmanby, 12; Keighley, 83; Kirkby Malzeard, 10; Knottingley, 27; Leeds (memorial of similar purport), 126; Ditto, East Ward, 101; Ditto, West End, 71; Lockwood, 72; Masham, 29; Milnsbridge, 42; Mossley, 51; Northowram, 71; Pudsey, 114; Redcar, 41; Richmond, 74; Rotherham, 70; Selby, 87; Shelley, 66; Southowram, 44; Thirsk, 49; Tickhill, 34; Wakefield, 70; Wilsden, 36; Woodhouse, 112;—making a total of 2,784 signatures.

He had also a memorial of the same nature from the Huddersfield Mechanics' Institution, signed by 459 members. This place, it would be remembered, was selected as the centre of provincial Examinations last year, and from that circumstance peculiar importance attached to that memorial. He thought it only right to state that these memorials were founded upon the supposition that it was the determination of the Council of the Society of Arts to abolish the Examinations altogether. Upon learning the real state of the case, he immediately caused a meeting of the committee of the Yorkshire Union to be convened, by whom the following resolutions were passed:—

"Resolved—That the committee learn with pleasure that it is not the intention of the Council of the Society of Arts to discontinue the Examinations, but rather to extend them as far as possible. The committee, however, regret to find that the Council contemplate abandoning the oral Examinations, and propose to conduct the examinations solely by printed questions sent down to the respective Institutes. They cannot but fear that this method will fail of success, and endanger even the continuance of the Examinations:—

"1. Because examination papers alone, without the assistance of oral examinations, cannot satisfactorily test the attainments of the students.

"2. Because without the presence of Examiners from the Society of Arts, there will be a liability to local partiality and unfairness, and the Examinations and Certificates will lose much of their importance in the estimation of the students.

"3. Because the personal visits of the Examiners to the various localities serve to excite interest in the officers and friends of the Institutes, and to vitalise the whole movement.

"4. That no practical obstacle seems to exist in the way of continuing and gradually extending the Examinations in the form in which they have been found to succeed so well; inasmuch as the highly competent men hitherto employed as Examiners are willing to visit the localities, and the Society possesses funds, derived from the Mechanics' Institutes, to enable them to remunerate those gentlemen for their services.

"Resolved—That this committee think it their duty to express their high sense of the zealous exertions of the Rev. Dr. Booth in introducing and conducting the examinations, to which exertions they cannot but mainly ascribe the success realised, and the public interest excited; and they would consider it a serious loss if the Institutes should be deprived of his services."

Mr. WYNDHAM PORTAL, who represented the Institutions of Hampshire and Wiltshire, presented the following memorial, signed by the secretaries of the Hants and Wilts Adult Education Society:—

"The undersigned, the secretaries of the Hants and Wilts Adult Education Society, are anxious to express their readiness to co-operate in any way with the Society of Arts, in promoting and carrying out their Examinations. They are glad that it has been determined to confine the Examination to written papers, as it will

enable the Society with ease and facility more widely and efficiently to extend the Examinations. The plan which has been adopted by the Hants and Wilts Adult Education Society, is referred to, and explained in, the following extract from the Society's report, presented October, 1856. There has never been the slightest reason to believe that the Examinations, under these provisions, have not been conducted fairly and honestly:

"The method of conducting the Examinations was as follows:—An application was made to the president of the Institution to which the candidate belonged, requesting his assistance in the nomination of three members, one or other of whom would be present during the whole of the Examination, and report that the answers of the candidates were given without any aid or assistance whatever. The whole was in writing. Two hours in the evening were fixed upon by the president, and allotted to each paper of questions, which was sent by that day's post to the president, sealed, and with a special direction on the cover, that they were to be opened in the room. The answers also were to be sealed up in the room, and returned with a certificate from the manager to the secretary by the post."

"This plan has the peculiar advantage of bringing home the Examination to each candidate, without cost of time or expense. While venturing to bring their own practice before the Society, the memorialists would wish it to be understood that they state it only for consideration, but that they are ready in every way pointed out by the Society to promote its objects, and to place their services at its disposal. Small local districts may readily be formed, if it be thought desirable, and in this their local knowledge might, perhaps, be available in the two important counties their operations embrace. If, on the other hand, it be determined to conduct the Examinations locally in each Institute, they will willingly undertake to aid in securing fairness and fidelity in the Examinations in all the Institutions in union with the Society of Arts, and the Hants and Wilts Adult Education Society in the district for which they act. While hailing with the greatest satisfaction the measures recently taken by the Universities, they would express an earnest wish that through the recommendation of the Society of Arts, or those friendly to such an extension, the age for the second or higher examination could be extended to 21 or even to 25 years. To render the boon granted by the Universities efficient for the purposes proposed, the extension would appear to your memorialists indispensable, inasmuch as it is intended to include those who, from a variety of circumstances, would never be able to receive a University education, and to whom, therefore, ample time and every opportunity and encouragement should be given to present themselves for Examination."

The SECRETARY then read letters enclosing resolutions in favour of the continuance of the Examinations, which had been received from the following Institutions:—Tailor's Labour Agency Literary Institute; Hitchin Mechanics' Institution, deprecating any essential change in the mode of conducting the Examinations; Lewes Mechanics' Institution; Manchester Mechanics' Institution, approving of the system carried out at Huddersfield, and deprecating any change; from the Wenlock Agricultural Reading Society; two letters from the Birmingham and Midland Institute, the first containing a resolution expressing their regret that the Society appears to contemplate the abandonment of the Examinations, and the second acknowledging the receipt of the Programme, and expressing their satisfaction at finding that their apprehensions were without foundation; from the Portland Breakwater Mechanics' Institution, expressing their entire concurrence in the course adopted by the Council; from the People's College, Sheffield, acknowledging the receipt of the Programme, and cordially concurring with the arrangements proposed by the Council.

Mr. JAMES GLAISHER, F.R.S., said, he believed that a letter had been received by the Council from Colonel Sykes, and he was desirous that it should be read to the meeting.

The CHAIRMAN ruled that the reading of the letter would be out of order.

The Secretary then read the Bye-laws proposed to be revoked, as follows:—

#### XII. THE BOARD OF EXAMINERS.

62. "To carry into operation the system of Examinations established by the Society, a Board of Examiners shall be elected from year to year in manner and form following:—On the first Wednesday in November, in each year, the Secretary shall summon all the members of the Board of Examiners to a meeting, due notice thereof having been previously given; and the members assembled, three being a quorum, shall proceed to nominate the persons whom they propose to be members of the Board of Examiners for the ensuing year. The Secretary shall cause a list of the names, thus proposed, to be printed and sent to each member of the Board, duly summoned, at the same time, to attend a meeting of the Board of Examiners on the second Wednesday in November. The Board of Examiners shall then proceed to select by ballot the persons who are to constitute the Board of Examiners for the ensuing year. No person shall be so selected unless he shall have had a majority of the votes of the persons then present and voting. The Chairman of the Board of Examiners shall certify, under his hand, to the Council the names of the persons so selected to act as the Board of Examiners of the Society of Arts. The list of selected names being submitted to the Council, duly summoned, for confirmation, it shall be competent for the Council to erase the name or names of any of the proposed Examiners from the list; and having confirmed the remainder, and appointed them to be the Board of Examiners for the ensuing year, to require them to proceed to nominate other fit persons to supply the vacancies in the Board of Examiners.

63. "Whenever a vacancy shall from time to time occur in the Board of Examiners, it shall be competent for the Board, duly summoned, to proceed to nominate, in the manner before described, a person to fill the said vacancy; and on his election being confirmed by the Council, he shall be admitted a member of the Board.

64. "Should the Council at any time, on the representation of the Board of Examiners, think proper to increase the number of Examiners, the election shall take place in the manner before described.

65. "The Board of Examiners shall elect a Chairman on the third Wednesday in November. He shall be elected by ballot. The Chairman of the Board of Examiners shall, *ex officio*, be entitled to be present at all meetings of the Council, and shall be duly summoned thereto.

66. "The Board of Examiners shall not vacate office with the Council, Officers, and Committees annually in June, but shall continue to hold office until the appointment of the succeeding Board in November.

Mr. HARRY CHESTER said, he had been requested by his colleagues in the Council to move the first resolution, and he would endeavour to do so without heat and without personality. As far as the Council and himself were concerned, they desired the discussion to be confined as strictly as possible to the business before them. The present meeting had been convened for the purpose of considering the expediency of repealing the five existing Bye-laws relating to the Examiners and substituting four others in their place; also to consider the Programme of Examinations which the Council had issued, and to take into consideration a requisition which had been received from Institutions in the North; and to pass such resolutions upon any or all of these matters as the meeting deemed proper. He begged to state at the outset that no question as to the continuance of the Examinations had ever been raised by the Council. They were obliged, under the Bye-laws, to include that subject in the notice for this evening's meeting, inasmuch as a requisition duly signed had been sent in to that effect; but if that question were put to the meeting, the Council, he need hardly add, would unanimously vote for it. It must be evident to all who had heard what had taken place, that a very large amount of misapprehension had prevailed as to the proceedings and the intentions of the Council in this matter, and he was glad to have heard the explanations with which Mr. Baines introduced the memorials he had presented. The only resolution which

the Council had to propose was that of the revocation of Bye-laws which they believed to be illegal, and the substitution of others which they considered to be in accordance with the Charter of the Society and suited to its present circumstances. The Bye-laws, which they proposed to revoke, had been read, and those which they proposed to substitute he would read, in formally proposing their adoption. The first point was, as to the illegality of the existing bye-laws, and this the honorary solicitor of the Society, who was present, would certify. He could with truth say that this matter had been carefully investigated at several Council meetings, attended by larger numbers than usual. It was no doubt true that upon paper there were thirty-five members of the Council. This number included H.R.H. the Prince Consort, who was President of the Society; the Marquis of Lansdowne, and other men of high position; but he need hardly say those gentlemen were not in the habit of attending the meetings of the Council. During the whole period that he had been connected with the Council, he never remembered any subject that had been dealt with at so many and such numerous attended meetings of that body; and it was a remarkable fact that those members of the Council who had voted upon any of the questions now under agitation had throughout been unanimous in their opinions. Therefore, in speaking in the name of his colleagues, he gave the result of the unanimous decision of those who had attended the meetings. The Council found that they were placed in circumstances of great difficulty. Their attention had been drawn to the fact that these bye-laws were in opposition to the terms of the charter, and therefore illegal. The Council, on two or three occasions, discussed that question, and came to the conclusion that these bye-laws were illegal, and in that conclusion they were fortified by the opinion of their legal adviser. The Chairman of Council, in his address at the opening of the present session, had stated generally the grounds on which the illegality rested—that, inasmuch as the charter vested the entire management of the Society in the Council, the existing bye-laws made the Board of Examiners an independent body, with power to prolong their existence when the Council and all the other officers had ceased their functions; with power to fix their own numbers; to nominate themselves, and to give to the chairman of the Board (who need not be a member of the Society) the right to attend all the meetings of the Council. He thought there could scarcely be a gentleman present who was of opinion that such laws could be maintained; and if they could not be maintained, then what was the plain duty of the Council under the circumstances in which they were placed? The proper course, if time had allowed it, would have been to call a general meeting of the members, and ask for an amendment of these laws, but there was no time for that. The occasion on which the Council met, was on the Friday previous to the second Wednesday in November. On that day the Board of Examiners had to nominate their successors. They had already put in nomination sixty-three persons whom they proposed to ballot for election, and if the Council had allowed the election of those gentlemen to have been completed, all of them would have been placed in a false position. The Council, moreover, had reason to know that an attempt was being made to create hostility between the Board of Examiners and the Council. The Board had themselves allowed that their functions had come to an end for the year, and on that ground had declined to comply with the request of the Council, to furnish them with a scheme for conducting the Examinations on the plan proposed by the Council, alleging that they were so near the end of their term of office and would not fetter the action of their successors. The Council therefore found that the only course open to them was to suspend the existence of the Board; but at the same time they distinctly expressed, by letter to each individual examiner, their intention of

renewing the Board as soon as they had received power from a general meeting, and as soon as they could do so in conformity with the terms of the charter. They therefore called this meeting together at the earliest time possible. They were surprised at the report which had gone abroad that it was their intention to *suppress* the Board of Examiners permanently, and to give up the system of Examinations. So far from their giving it up, the question had never been raised in the Council; notwithstanding this, circulars had been sent to the Institutions making the assertion that the Board of Examiners had been suppressed, and creating an agitation against the Council. In these circulars, which were signed by Mr. Brewer, who was not even a member of the Society, but a candidate for election as a member, it was stated that a meeting of the late Board of Examiners had been held, though this was not the fact, as several leading members of the Board—he knew of six—had not been invited to attend, and gentlemen who had never been appointed Examiners were invited. He confessed his great surprise that such a course had been adopted. All that the Council desired was to bring the Board of Examiners into harmony with the constitution of the Society. The Council desired to treat the Board of Examiners with every respect; they entertained the highest sense of the services they had rendered; but whilst the Council were entrusted with the management of the Society's affairs, they could not consent to an *imperium in imperio* of that description. He trusted the time would never come when the Council would submit to the dictation of any body except the general body of the members, to whom alone they were responsible. The Bye-laws which he had to propose in substitution of those now existing were as follows:—

#### XII.—THE EXAMINERS.

“To carry on the system of Examinations which the Society has established for the students of the Institutes in union with it, the Council shall, as soon as possible, appoint a Board of Examiners for 1858, and shall hereafter, at their first meeting after the annual general meeting in June, or as soon afterwards as may be, appoint a Board, or Boards of Examiners; and the Council shall have full power to fill up vacancies therein, and to enlarge, reduce, or otherwise vary the number of the members thereof.

“Every such board for the time being, and from time to time, shall have power to appoint one of its own members, being a member of the Society of Arts, to be chairman of such board.

“The Council may make such payments as they shall deem meet, to those Examiners who shall set the Examination questions, and pass judgment upon the answers; but no such payment shall be made to any Examiner being a member of the Council.

“Whenever it shall appear to the Council that any Examination, commenced by a Board of Examiners, cannot be properly concluded, and the awards made by that Board, before the period at which its existence would naturally be determined, viz., at the annual general meeting in June, the Council shall report the same to that meeting, and the meeting may at once re-appoint the said Board, and resolve that it shall continue in existence till its work is done, or till the new Council shall otherwise provide for the same.”

The first of these bye-laws simply placed the Board of Examiners under the authority of the Council. The Council had determined, in obedience to the resolution of the last general meeting, to give up the Examination of the pupils of private schools. Schools were carried on commercially, and the Society of Arts had no means of distinguishing between the most respectable school and the veriest Dotheboys Hall. The Society of Arts must not attempt to set itself up as an educational Society or as an university. It was an Institution for the Encouragement of Arts, Manufactures, and Commerce, and it was upon that basis they desired to proceed. To set up the Society as a great university would only bring ridicule upon it. He was glad to see that there was not likely to be much response to the sentiment that had been expressed that the Society of Arts was defunct. The only basis upon which the

Society could do anything was that which the charter laid down—the encouragement of Arts, Manufactures, and Commerce. There were about 350 Societies in Union with them, and they were entitled to examine the students of classes in those Institutes. The second of the proposed bye-laws would give the Board the power of nominating its own chairman, and they had inserted the proviso that the Chairman of the Board of Examiners should be a member of the Society of Arts. The next bye-law was to enable the council to remunerate the Examiners for their services. He believed that the members of the Society were hardly aware of the great extent to which the Examiners had given their services gratuitously. They had not merely undertaken the work of examination, but had met time after time and week after week. The council was of opinion that the Board of Examiners should not be an executive body—that the council and its officers should conduct the business connected with the Examinations. The work of the Examiners ought to be confined to the setting of Examination papers, and passing judgment on the answers. He hoped the meeting would not suffer their minds to be prejudiced by the memorials which had been sent up from Institutions in the country, under a misapprehension of the true state of the case. Mr. Baines, directly he found out that the Institutions over which he presided had been misled, and that the intention of the Council was not to give up the Examinations, but merely to make some alterations in the mode of carrying them on, took the earliest opportunity of setting them right; nevertheless, this misrepresentation had been circulated with great industry. Circulars had been sent to all the Institutions in connexion with the Society, leading the Institutions to believe that the Society was going to give up the Examinations. The circular which he had before alluded to, signed by Mr. Brewer, and dated King's College, London, 16th November, 1857, had been put into his hands. This circular was issued after the Council had, in the most positive manner, stated that there was no foundation for the impression that they intended to give up the Examinations. The writer was, moreover, not a member of the Society, and it seemed strange that a gentleman, in the position of a candidate for election, should issue such a circular. Without calling at all into question that it would be expedient to have oral combined with written examinations, if it were possible, the Council having most carefully considered the subject, was of opinion, and at one time in the present year the Board of Examiners was unanimously of opinion that it would be necessary to give up the oral examinations altogether. The Council, with the exception of the late chairman, had, after most careful consideration, arrived at the unanimous opinion that the oral examinations could not be carried on satisfactorily at a sufficient number of places, that it was impossible to provide against the enormous expense of carrying out that system in a manner satisfactory to the Society. It was mocking the different institutions throughout England, Scotland, Wales, and Ireland, to take their money from them, to offer to examine their students, and then to confine the examination to a few centres. The Council now invited the local authorities to take a larger share of responsibility and authority in the management of the examinations. Examinations by papers might be held anywhere. Any member of an Institution in union, however distant—however poor, however humble, his attainments—might now be made to feel the stimulus of the examinations of the Society of Arts. The local boards could examine orally, but it would be impossible to carry out that plan by Examiners sent from the Society. The meeting would gather from the programme that all those persons who, having passed a previous examination, seemed to the authorities of the local boards to possess attainments which would make it expedient for them to enter into the larger competition, would have their

names sent up to the Society; the Society would examine them, and award prizes and certificates to the most deserving. The Council heartily rejoiced in the movement at the two universities, and having no sympathy with those who derided them, had proposed to give certain assistance to persons who, by distinguishing themselves at the Society's Examinations, might give reason to hope that they would be able to obtain the new degree of "Associate in Arts."

Mr. J. GRIFFITH FRITH seconded the motion.

Mr. TOOKE, the honorary solicitor of the Society, in reply to a question, said that he had no doubt whatever as to the illegality of the Bye-laws sought to be rescinded, and had not considered it necessary to take the opinion of Counsel on the subject.

The SECRETARY then, at the desire of the meeting, read the portion of the Charter relating to the powers and duties of the Council.

Mr. BAINES said he wished to know whether the carrying of the resolution was intended to involve the approval of the whole of the plan in opposition to that already in existence.

Mr. CHESTER said that the passing of the Bye-laws would merely give to the Council for the time being the power of appointing a Board of Examiners to carry on the business, but would in no way fetter any expression of opinion on the part of the meeting in reference to the mode of conducting the Examinations.

The CHAIRMAN, in putting Mr. Chester's resolution, intimated an opinion that the bye-laws were not only illegal but absurd.

The resolution was carried unanimously.

Mr. BAINES said, that after the statement of the Society's honorary solicitor that the Bye-laws were contrary to the charter, he did not feel it right to vote in favour of maintaining them, but he conceived that that did not touch the great question relative to the distinction between the two plans of conducting the Examinations in Mechanics' Institutes. He entirely concurred in Mr. Chester's remarks relative to the exclusion of the pupils of Commercial Schools from these Examinations; they were in another category altogether from the students of Mechanics' Institutes. Although the numerous memorials presented from Yorkshire did not pronounce a distinct opinion between the two plans, yet it might naturally be concluded that they were in favour of that system of Examinations which they had seen practically at work among them. The oral part of the Examinations was a very essential feature of the system. Without the personal presence and visits of gentlemen from that Society, possessing the weight which men of science, and of public spirit in the metropolis, deservedly held throughout the country, the Examinations would not be carried on in a satisfactory manner. He believed that Mr. Chester had proposed a plan of Examination by written papers at an earlier period, but it was not found to be attractive to the members of the Institutions. On the other hand, there was a plan which had been in successful operation for two successive years, having been first tried in the metropolis only, and afterwards extended to Huddersfield. Entire satisfaction had been expressed at its working by those connected with the Examinations, except in some minor details. In Yorkshire these Examinations were felt to give the stimulus that was absolutely required to the most important part of the Mechanics' Institution, namely, class instruction. The object was to make their evening classes as successful as possible. They wanted to stimulate their young men to study. Dr. Booth had visited their various institutions; he visited them at Leeds—he proceeded to Huddersfield and Middlesborough, and personally introduced that system; and he (Mr. Baines) did not hesitate to express his conviction that if it had not been for the presence of Dr. Booth, and for the zeal and ability with which he had pushed that system of Examinations personally among the members of committees

and teachers of the different Institutions, it never would have come to anything in the North. He should be acting most unjustly to a public man if he did not state that as far as he could possibly judge they were indebted for the actual existence of the plan in operation in the north of England entirely to the exertions of Dr. Booth. He believed it was only by the personal presence of some of the Council amongst them that much could be done; he did not mean to say that without their presence success could not be attained; but the system would be immensely more likely to succeed if the Society sent down Examiners for the purpose of conducting Examinations among them. They would be much more certain of fairness and impartiality if Examiners were sent down from London to conduct the Examinations. There was an undoubted advantage in oral Examinations over Examinations by written questions, in getting at the real attainment of persons under Examination. If there was any case in which written Examinations were not quite satisfactory, this applied to Mechanics' Institutions, many of the members of which, while they possessed high mathematical and mechanical attainments, would be unfairly treated if judged by the answers which they might set down upon paper. He might mention the case of the teacher of the Huddersfield Mathematical Class, who was a plasterer, but who had attainments of so high a character that he successfully conducted a mathematical class, and infused into others that enthusiasm which he himself experienced. He believed that it would do the greatest possible injury to depart from the plan of oral examination, and he therefore proposed the following resolution:—"That, in the opinion of the meeting, it was desirable to continue the present system of Examination, including Oral Examination, by Examiners of the Society of Arts."

Mr. WATTS seconded the motion.

Mr. J. G. CRACE said he considered that education ought to be encouraged, but that there ought to be proper societies to do it. It should not be the Society of Arts, Manufactures, and Commerce that should stand alone in matters of that description. Their funds, their time, their energies, ought to be more worthily exercised in advancing the great objects of their charter.

Mr. THOS. WEBSTER, F.R.S., said, he looked upon the educational movement, or this system of Examination, which the Council had established, as one of those great steps of progress that the Society had been so eminent in carrying forward. He trusted, however, that the Council would not allow themselves to be diverted from the legitimate objects of the Society, and indeed he had no fear upon that point. At their weekly meetings, discussions had taken place upon what were most legitimate objects—Arts, Manufactures, and Commerce. No one would venture to assert that the legitimate objects of the Society had been sacrificed. He thought that no one who had had any experience in education—no one who passed through the universities, who knew how the men there were trained for Examination on paper—no one who knew the character of the men who were to be examined in connection with the Institutions—no one who knew the success of that great educational experiment that was being carried on under the Committee of Council, could doubt that oral Examination was the most valuable adjunct they could possibly have. If practicable, oral Examination ought to be carried out. If Dr. Booth, Mr. Baines, and others, told them it was practicable, he could not but hope that some means might be adopted to give a fair trial to the system.

The Rev. RICHARD WHITTINGTON said, he was the honorary secretary of the Crosby Hall Evening Classes. He most cordially agreed with Mr. Baines in almost everything that gentleman had said, and was most anxious to see the system of oral Examination carried into effect. He agreed with Mr. Baines as to the necessity of having some of the Examiners of the Society present at the Examinations. Without this there never

would be a guarantee for the honesty of the Examination. The certificate would not be half so valuable unless the Examiners were present.

Mr. VARLEY, after an experience of forty years, felt bound to agree with Mr. Baines's proposition. Many a man who could hardly write had materials within him which would very soon show themselves in oral examinations.

Mr. WILLIAM HAWES said that no one could doubt the truth of the statement that had been made by Mr. Baines, but the question was not the abstract one of what was the best mode of promoting the education of mechanics, but what means were within the reach of the Society to promote that education to the utmost extent. Several statements had been made with reference to which he believed a considerable amount of inaccuracy existed. If they looked at the Universities, they found at one a system of oral, and at another a system of written Examination, but the new system, of which Oxford had already published the programme, was confined exclusively to written Examination for those above 15 years of age. They had been told that the presence of the Examiners from London, was essentially necessary to secure the fairness of the Examination. The question was, were they to limit the number to be benefited by the Examinations, to those who could afford to travel to a few places only. He thought the usefulness of the Society would be limited by oral Examinations, which required such a large number of Examiners. It they took the more extended and better system they would have the whole of the candidates tested by one body of men, and a uniformity of certificate which would give a fixed value to the operations of the Society. The Council were anxious that the meeting should thoroughly and decidedly express their opinion upon the subject, because it was one upon which the utility of the Society materially depended. The cost of one centre in London, and one in the country, last year, the Examiners giving their time gratuitously, was so great, that if they multiplied it by eight or ten, the income of the Society would be almost swallowed up. It was not for the societies in the country to call upon them to spend the whole of the funds of the Society upon this one object. He hoped the meeting would leave the decision in the hands of a number of gentlemen who had hitherto conducted the business of the Society with great success. Let them carefully consider the subject, and rely upon the Council for the proper management of the business of the Society. He trusted that they would not, by adopting Mr. Baines's resolution, cast a stigma upon the Council.

Mr. BENTLEY SHAW said he was of opinion that the Institutes owed a debt of gratitude to the Society for the benefits they had received from it. He had joined the Society in order that the Mechanics' Institution near Huddersfield might be connected with it. He entirely agreed with Mr. Baines with respect to the benefits resulting from oral examinations, and he trusted, for the sake of the working men that this plan would be carried out. The very best possible mode of promoting Arts, Commerce and Manufactures, was by educating the working classes to the greatest possible degree.

Mr. THOS. SCOTT moved the following amendment: "That the Council of this Society be instructed not to expend any of the Society of Arts' funds in education, unless specially granted for that purpose."

Mr. J. G. CRACE seconded the amendment.

The CHAIRMAN ruled that, as the amendment was in direct contradiction to the Bye-laws which had just been passed, it could not be put.

Mr. JOSIAH WILKINSON said, the simple question was, whether oral or written examination could be conducted with the greatest advantage to the Society. He could not concur, to the full extent of his motion, with Mr. Baines. He thought they would be acting unwisely if they in any way attempted to fetter the Coun-

cil in the measures which they thought it right to adopt, although he was struck with the observations of Mr. Baines, relative to the fear of partiality in local examinations, as well as to the imperfection attending written examinations; still he thought that if they adopted oral examinations with a limited number of centres they would do injustice to all the Institutions at a distance from these centres. There were 14 different subjects of examination proposed; conceive the difficulty of sending down qualified men to examine on 14 different subjects, at half-a-dozen centres. They had no right at present to sanction such an expenditure as that which had been contemplated. He proposed to invite the meeting to leave the hands of the Council entirely unfettered, and therefore would offer, as an amendment, "That this meeting, while it recognizes the value of oral Examinations, continues to have entire confidence in the Council of the Society, and entrusts to it the working out of the question of Examination among the Institutions in Union."

Mr. J. MCGREGOR seconded the amendment.

Mr. HYDE CLARKE said—Concurring as he did, to the fullest extent, in the great value of oral examination, he yet felt that the Council would be placed in a difficult position if Mr. Baines pressed upon the meeting the motion he had proposed. There was nothing in the motion itself from which from which he could dissent, but he thought a motion of that kind would tend to embarrass the Council of the Society, and even the Mechanics' Institutions themselves; because, although the mover of the resolution came there as the representative of a large union of Mechanics' Institutions, yet they had evidence in the memorials themselves that there was difference of opinion amongst those Institutions. Then as to the cause of education itself, he was in doubt whether they would not inflict a serious injury upon it by adopting oral in preference to written examinations; for, whatever might be the abstract superiority of the former, it was evident from what they had heard that the system of oral examination could touch only about 400 candidates, but under the written plan they might examine much greater numbers. He feared that in supporting this motion they would be injuring the cause of education; he therefore hoped the mover of the resolution, having succeeded in obtaining some expression of feeling in favour of oral examination, would not insist on putting the Society in a position of difficulty, but would withdraw his motion.

Mr. SAMUEL MORLEY said the resolution of Mr. Baines only went to the extent of expressing a wish to continue the system as it had hitherto been carried out. From the speech of Mr. Hawes he gathered that Mr. Baines's resolution was regarded as a wish to change the course already adopted. If so there was a great misconception of Mr. Baines's meaning. That gentleman had brought with him evidence that the Mechanics' Institutions of Yorkshire were in favour of oral examination. He had given reasons in favour of that system, and it was a serious thing to speak of Mr. Baines's resolution as a stigma upon the Council. He (Mr. Morley) did not understand it as such. Mr. Baines had merely advocated the existing system. He had shown that, although scarcely begun, it had worked admirably. There were certainly imperfections in it, but it excited interest in the cause of education. He contended that Mr. Baines was not entitled to be spoken of as reflecting upon the Council, or wishing to obtain the assent of the meeting to a merely abstract proposition. Then with reference to education itself, if they determined that this Society should have nothing to do with education, it would become the dead thing it was twenty-five years ago. He spoke in the interests of trade when he asked them to stand by education and largely extend their operations in that direction. It was not enough that the scientific subjects of the age should be discussed as they were in the most able manner, at their weekly meetings. In



these days of progress and effort it was a glorious thing to combine these with the furtherance of the cause of education. He endorsed the views expressed as to the value of personal communication with the Institutions throughout the country, and he could not but express his admiration of the course which Dr. Booth had adopted. He had read too many of the addresses of that gentleman not to express the admiration he felt at the energy he had shown in the cause of education. He particularly referred to the late address of Dr. Booth before the Mechanics' Institution of Manchester. In conclusion he begged the Council to pause before they altered a system which had hitherto worked so well.

Mr. G. F. WILSON, F.R.S., said, having strong feelings in favour of oral Examination, and being connected as President, with two Mechanics' Institutions numbering 600 members, he would, in a few words, state why, as a member of the Council, he had adopted the views of his colleagues in favour of written Examinations. They had the experience of the last year; a very important experiment was then tried. It was not without some difficulty that competent Examiners could be obtained, sufficient for the number of centres then proposed. The Council, carefully considering the matter as men of business, came to the conclusion that they could not extend the system of oral Examination in a way to give real results. They might see it noticed in the newspapers that the Society held Examinations in a great many places, but the results could not have been real. The meeting could not fail to be struck with the remark of Mr. Baines, that even in the very stronghold of Mechanics' Institutions, with all his personal influence there, it required all the efforts of the Society thoroughly to organise the Examinations in that local centre.

Dr. CARPENTER, F.R.S., said, having acted as an Examiner, and having taken a deep interest in the system ever since its commencement, and having had nine years' experience as an Examiner in the University of London, he thought he could make one or two remarks upon the subject which might help the meeting in coming to a conclusion upon it. With regard to oral examinations superadded to written, his own experience and that of a great many other Examiners had been this—with reference to educated young men, the great value of oral examination was in checking cramming. Dr. Carpenter then referred to some instances coming under his own observation, to illustrate this view. He (Dr. Carpenter) was on one occasion in danger of rejecting a very deserving candidate who failed in written examination merely from slowness and for want of power to put upon paper knowledge which upon oral examination he was found to possess. He had a very strong conviction that for any perfect system of examination oral in addition to written was an essential element. He, however, appreciated the difficulties in which the Council of the Society found themselves placed; he entered also into the financial difficulties of the question, and the issue seemed to be this:—The Council, if they thought it best for the interests of education, would be prepared to carry out the system of examination upon its first footing, that was, one, in London and one in some other centre, at which oral examinations should be conducted, but he could understand the difficulty of extending the system beyond these two or three centres, and he could enter into the wish of the Council to extend the benefits of the examinations as widely as possible, by giving the opportunity to a large number of Institutions to take a share in them. The question then was this—Was it best for the interests of education, the interests of the Society, and the interests of the Institutions, to have what he must characterise as an inferior and imperfect examination carried on extensively, and to give certificates upon an imperfect system, which would not have the value which the certificates upon a better system would have. What he thought best was to confine the examinations to two or three centres, capable of extension as the funds allowed, but carried

out upon the best possible principle. He could not conceive that any censure would be cast upon the Council by the adoption of either of these two plans. For his part, he was strongly in favour of keeping the Examinations at a high standard, and making them to be felt an honour and a credit. However, he was for leaving this question to the decision of the Council, as they were the persons who were constantly in communication with the various Institutions throughout the country, and were always ready to act in accordance with their views. He believed the Council were best fitted to carry out the objects of the Society, and he should give his support to the amendment which had just been proposed.

Mr. CHESTER did not agree with the gentleman who had said that the carrying of Mr. Baines's resolution would cast a stigma upon the Council. He believed there was no such intention. At the same time, if the resolution were carried, the Council would feel it as a withdrawal of the confidence of the Society. The Council would pay all due deference to the decision of the meeting, but they would regard that resolution, if passed, as a withdrawal of confidence in them. He was not for a moment prepared to contend that after what had passed the Council might not reconsider the subject, but he should mislead the meeting if he held out the hope that the present Council would be able to carry out a system of oral examination by the Society's own Examiners. This subject had been discussed at three meetings of the Council, to the exclusion of any other matter, and after the most careful and painful deliberation, they came to the conclusion, 12 to 1, that it was impossible to carry out the oral examinations. Mr. Chester then referred to the minutes of a resolution passed in February by the Board of Examiners. There were twelve Examiners present, and they passed an unanimous resolution, moved by himself and seconded by Dr. Booth, to give up oral examinations after the year 1857. He did not contend that it would not be desirable to combine the oral with the written, if possible; but he was certain, if this meeting could constitute itself a Council to discuss the ways and means, they would come to the conclusion at which the Council had arrived. A great deal had been said as to the impossibility of carrying on these oral Examinations by the Society in a great number of different places. He was prepared to say they could not carry them on in London alone. If the system succeeded, they would have such an immense number of candidates from London alone, that it would be impossible to conduct the Examination of so large a number orally, considering the time necessary to do justice to each candidate. The friends of education, of whom he was one, must see that there was a feeling among some members of the Society against these Examinations altogether. The Council had given the subject their fullest consideration, and they were of opinion that they could do perfect justice to all the other important objects of the Society, if the programme they had issued were carried out, but they could not do so if the members insisted upon oral Examinations. A part of their plan was, that Examinations should be held previously in the different localities, and in all those localities the Examinations might be conducted orally if it was thought necessary. It pained him very much to hear Mr. Baines—the champion of local authority in education and of the voluntary system—tell them that they could not trust the local bodies to carry out these Examinations. If they could not trust them, then let them give the whole thing up. If the oral system were attempted, it would be impossible for the Society to carry on the Examinations, and the whole scheme would be handed over to the Government. Then the plan which had been before them for the last ten years, in Dr. Booth's celebrated pamphlet, would be realised, and we should indeed see "Examination the Province of the State." What they all desired to see was the development of local authority in education; they wished



to see local boards rise in importance. He hoped that out of all this some agency would arise which would take the place of the Society of Arts. The Society would show what ought to be done, and how it was to be done; and ultimately it was to be hoped that the local authorities would develop something exactly suited to their wants.

The Rev. Dr. BOOTH, F.R.S., merely rose to call attention to some of the regulations which were laid down last year for conducting the Examinations. In those regulations he held that the entire system of local boards and local management was recognised as put forward in the programme just issued by the Council. Should he tell them his own experience of how that worked? They had only one board in all England that was able to comply with the regulations sent down, and that was at Wakefield. So far from those regulations being carried out, the Secretary knew that they had to violate their own conditions, and admit candidates to Examination from Institutions where there were no classes for instruction and no local Boards for previous examination. They had constantly to violate their own regulations until at last they became absolutely a dead letter.

Mr. HENRY COLE, C.B., was in favour of oral Examinations where they could be carried out, and he believed a combination of oral and written was the best system if practicable. With reference to what Mr. Baines had stated, did that gentleman believe that it was impossible, with such men as himself and Dr. Hook, and Mr. Beckett Denison, to establish local boards for Examinations? He would ask Mr. Baines whether he was honestly of opinion that he could not get an impartial Board of Examiners in Leeds. He (Mr. Cole) was of Mr. Baines' opinion with regard to oral Examinations, but if they could only have one Examination in London and one in Yorkshire, they deprived the other Institutions of that advantage, and candidates could not be examined unless they travelled to Huddersfield or London. This would not be doing justice to the other Institutions throughout the country. The Council wished to carry out the system of Examination which would be the most generally available, but if the meeting persisted in voting for oral Examinations, it was tantamount to saying that the Council did not know how to conduct the business which they had so fully discussed. They had before them the instance of the Examinations at Huddersfield last year. The Council, then, had difficulty in getting Examiners to go there. To have attempted to carry them out in another centre simultaneously, would have been absolutely impossible; and even the Board of Examiners had discussed this subject, and come to a resolution in favour of paper Examinations. He thought it was possible to do something in the way of oral Examinations, but if he were asked whether it could be extended to the 350 Institutions in union, he should decidedly say it was impossible. Let them try to do the best they could for those Institutions, but they should pause before they rushed into a system which, upon the face of it, was impracticable for all.

Mr. BAINES might, with the same good humour with which Mr. Chester had twitted him with regard to the voluntary system, turn the argument against that gentleman himself, and ask how it was that he, as a State educationist, sent persons from Downing-street all over the country, whilst, at the same time, he argued in favour of local authority, without aid from the metropolis. Mr. Cole had asked whether he (Mr. Baines) could not form a board of Examiners in Leeds? He would not say it was impossible; but candidates who were disappointed in their hopes would not be satisfied that the Examination had been as fairly and openly conducted, free from all local and even innocent partiality, as if gentlemen were sent down from London to conduct the Examinations. Mr. Chester appeared to regard it as a crime to ask poor young men to go to a distance to be examined. In Leeds there were a number of young men who stood a fair chance of successful examination; the Institu-

tion paid their expenses, and Bradford did the same, and candidates were sent to London and to Huddersfield; therefore the objection of Mr. Chester on that ground was not valid. They might increase their centres, and yet not make them so very numerous as some appeared to apprehend. Last year they had one local centre; this year they had two. It had been proposed next year to have five, and his belief was, that they would have found those five so successful that they would have rejoiced in after years to extend them to ten and twenty. He knew they might state difficulties in the way of anything. He stated difficulties when Mr. Chester brought forward his plan for the union of Mechanics' Institutions with the Society of Arts, and he very well remembered the answer of Mr. Chester, "We know there are difficulties, but we know how to cope with them, and we will overcome them." In like manner they could overcome the difficulties connected with these Examinations. He was not advocating innovation, but only the gradual extension of the system already adopted. They had gone to Lord Palmerston and the Right Hon. Mr. Cowper, and had asked them to leave the examination of Institutions in the hands of the Society, pledging themselves to carry on such Examinations. It was said by Mr. Chester, with a degree of confidence that startled him, that they could not examine orally even those who presented themselves in London. He would not set up his opinion against that of Mr. Chester, but he would set up the opinion of a body of gentlemen who he thought ranked still higher as authorities on this particular question than even Mr. Chester himself, namely, the Board of Examiners. Mr. Chester had quoted a resolution passed by the Board in February last. He (Mr. Baines) would quote a resolution passed by the same body in October last. The resolution stated that the Board believed it to be desirable to secure the confidence of the public in the integrity of their decisions, that every central examination should be superintended by two or more members of the Board. The great expenses of the last examination had been mentioned, and it was argued that if the centres were multiplied the expenses would be multiplied in the same proportion. He submitted that that would not be so. There were expenses of printing, &c., which attached to the Examinations, which would not be perceptibly increased. The travelling expenses would be increased, but after all the Society had done, were they to be baffled by being told that it would require a few hundreds more to carry out a system of Examination in which every one had confidence, and which was immeasurably superior to the system of mere written papers? He had come prepared to hear difference of opinion upon the subject of oral examinations, but there was very little. He would say to Mr. Hawes, who used the expression that if his (Mr. Baines) resolution were carried, it would be a stigma upon the Council, that nothing was further from his intention than to cast any stigma upon that body. They were called together to discuss a question of vital interest, namely, the Examinations, which was a matter entirely apart from personal considerations. He had one further remark to make. From the knowledge he had of the Institutions in the country, he was bound to tell the meeting that if they came to a decision opposed to the spirit of the resolution he had submitted, that decision would create grievous disappointment. It would be regarded as a complete change in their system. This was the one grand point in question. It was on this they were called upon to express their opinion, and he hoped the decision would be one that would tend to promote still further the connection of the Mechanics' Institutions of England with this great and important Society.

The CHAIRMAN then read the original motion, and also the amendment. On the amendment being put from the chair, it was carried by a very large majority.

Mr. E. B. DENISON then submitted a motion to the effect that the expenses incurred by Dr. Booth in the printing of a pamphlet issued by him in his own defence should be defrayed out of the funds of the Society. He submitted this motion without any previous communication with Dr. Booth, and wholly without that gentleman's cognizance, and was prompted to do so because the pages of the Society's *Journal* had been closed against Dr. Booth, unless he consented to submit his statement for the approval of the Council, which he could hardly be expected to do.

Dr. BOOTH extremely regretted that such a proposition had been made, and he begged Mr. Denison at once to withdraw it, as he had already paid the expenses of printing his pamphlet.

The proposition was withdrawn.

Mr. TOOKE proposed a vote of thanks to Mr. Bodkin for the very admirable manner in which he had presided over the business of the meeting, which was seconded by Mr. Dilke, and carried by acclamation.

The CHAIRMAN returned thanks, expressing his gratification at the amicable spirit which had characterised the meeting.

### THIRD ORDINARY MEETING.

WEDNESDAY, DEC. 2, 1857.

The Third Ordinary Meeting of the One Hundred and Fourth Session, was held on Wednesday, the 2nd inst., George Lowe, Esq., F.R.S., in the chair.

The following Candidates were balloted for and duly elected members of the Society:—

Abbott, Edwin Morton	Hastings, George Woodyatt
Adams, James, jun.	Hawkes, Rev. H.
Bicknell, Algernon, S.	Hooper, William
Botterill, John	Jackson, Edwin Ward
Brooks, Maurice	Jenkyns, Ivan Charles
Brown, Edward M.	Kendall, Rev. J. H. F.
Brown, Chas. Blakely, M.D.	Kitson, James
Brown, John	Leary, George David
Browne, Rev. Prof. Robert	Levy, William Hanks
Catt, Henry	Manning, John
Charlesworth, John C. D., M.P.	Mewburn, Francis, jun.
Clegg, Thomas	Peover, George
Colquhoun, John Campbell	Ranger, William
Coulton, Isaac Love	Reeve, Charles
Cressingham, Jonah	Roberts, James
Davies, Evan, M.A.	Roupell, William, M.P.
Garraway, George	Rumball, Thomas
Grassett, Elliott	Rumney, Robert
Hall, William Bancks	Sandeman, Thomas G.
Hamilton, Archibald	Seale, Sir H. P., Bart.
Hamilton, William, R.N.	Shout, Thomas Hammond
Hardy, T. Duffus	Vaughan, Edward P. H.
Harris, Alfred, jun.	Wood, John
Harris, George	Wooley, Thomas
	Young, David Alexander

The following Colonial Institution has been taken into Union since the last announcement:—  
Swan River Mechanics' Institution, Western Australia.

Previous to the reading of the Paper, the Secretary called attention to some specimens of double and triple salts of Ammonia, Magnesia, Soda, and Potassa, which had been placed in his hands by Sir James Murray. A description of these will be found in the present number of the *Journal*, at page 47.

The CHAIRMAN complimented the author of the paper about to be read, as having for many years devoted his

energies to work out that '*vezala quæstio*,' the comparative heating powers of coal and coke. He was happy to see around him many who had signalled themselves in this matter of producing the most heat and the least smoke. He would only add that he trusted the discussion of Mr. Pellatt's paper might partake of a practical rather than a scientific character, as, doubtless, one pound of bituminous coal, having all its hydro-carbon saturated with oxygen, must give more heat than the same weight of coke or anthracite, but the facts of daily practice were wanted.

The Paper read was:—

#### ON THE COMPARATIVE HEATING PROPERTIES OF COKE AND COAL IN REGARD TO ECONOMY AND THE PREVENTION OF SMOKE.

By APSLEY PELLATT.

The coal fields of Great Britain may be considered as the substratum of our commercial wealth, but for this munificent gift of Providence, our manufacturing steam-powers could only, in a limited degree, be maintained.

The abundance of this almost inexhaustible supply of fuel enables us to propel our locomotives, floating batteries, steam mercantile marine, and millions of spinning jennies, mules, &c., in our textile workshops, affording also the means of fusing minerals, metals, &c., and of bringing formerly useless residuum into valuable chemical products.

To enable us commercially to compete with foreign rivals, we should not simply rely upon our abundance of coal and the improved modes of ventilating and working our mines; we should also consider the heating powers of coke as compared with coal, in order to ascertain which is the most effective fuel in reference to economy and reduction of smoke. These are points well worthy of our practical deliberation.

The most striking example of apparent indisposition to reduce the smoke nuisance has been recently exhibited at Manchester, by the dense volumes of smoke almost constantly issuing from her countless tall manufactory chimnies, which so excited the attention and astonishment of strangers on their recent visit to the great Exhibition of Art Treasures. Any person ascending one of those immense manufactories, in expectation of getting a bird's-eye view of the city, would only behold a dense murky floating vapour of smoke. Sheffield, Leeds, Birmingham, Newcastle, and most of the great Northern towns, rival Manchester in impurity of atmosphere and, probably, in wasteful consumption of coals. The southern and eastern localities of the metropolis were worse, in that respect, than the cities of the north, until, by the stringent operation of Lord Palmerston's Smoke Act, metropolitan manufacturers were forced to use coke and other smokeless fuel, or to adopt some smoke preventing apparatus. Any person standing upon either of the bridges of Blackfriars, Waterloo, or Charing Cross, on a fine day, looking up or down the River Thames as far as the naked eye can carry, will notice a much clearer atmosphere than formerly, a convincing proof that owners of steam vessels above bridge, and proprietors of metropolitan manufactories, mills, and breweries, on both sides of the river, by complying with the requirements of the Smoke Act, have succeeded in freeing that part of the metropolis from smoke to a greater extent than most manufacturing towns or cities in England.

It is true that Lambeth (and its potteries) is still a nuisance, greatly complained of by the South-Western Railroad travellers and others, and will, in a great measure, remain so, until the New Smoke Act of 19 and 20 Victoria shall be brought into operation, viz., on the 1st of January next, 1858. Several years prior to the passing of the Smoke Act of 1853, a commission, at the recommendation of the House of Commons, was appointed, consisting of the late Sir Henry de la Beche, and Dr.

Isaac Lyon Playfair, who, having visited the manufacturing districts, reported that in the event of smoke legislation taking place, potteries and manufactories of glass and iron should be exempted from the Act, until the further progress of practical science would allow of their being placed under the same category as all other factories; that period it is considered has now arrived, therefore, under the provisions of the new Act, all smoke-making manufactures must soon comply with its requirements or submit to its penalties. Messrs. Doulton and Sons, the eminent potters of Lambeth, are in advance of most of their neighbours, having erected several kilns on an improved construction, for bringing the bituminous, as well as the carbonaceous constituents of coals into combustion within the furnace, allowing only the comparatively transparent light vapours to escape through the chimnies or cones, and no new factories are allowed by the Government to be erected in that locality unless they are comparatively smokeless, it therefore behoves smoke-making potters to be on the alert in immediately effecting their improvements.

[Mr. Pellatt described the arrangement and action of a smoke-consuming furnace for Potteries, invented by Mr. Doulton. A description of this will be found in the *Society's Journal*, vol. 4, p. 601.]

Some potters have mixed with their coals a large proportion of gas coke, which not only economises fuel, but reduces smoke; other manufacturers have also used a large proportion of gas coke advantageously. Messrs. Williams, Parkes, and other writers, led the attention of the manufacturing public to the heating powers of coke many years since, and one of the intentions of this paper is to revive this interesting subject, and to explain its advantages by practical remarks and quotations from scientific authors, in the detail of experiments which have proved the economy of using gas coke partially or wholly, instead of coals, in localities where it may be purchased comparatively cheap. Mr. Wye Williams, of Liverpool, who published as far back as 1840, has recently received a prize from the Society of Arts for his practical and scientific essay "On the Smoke Nuisance."

Mr. Joseph Parkes, about the year 1850, read several papers before the Institution of Civil Engineers, detailing experiments he had made on the relative calorific power of coal and coke for evaporating water.

I also read a paper on the same subject before that Society, giving an account of experiments I had made with coke for melting glass, which confirmed Mr. Parkes' results, viz., that one chaldron of coke, weighing 13 or 14 cwt., performed the same heating duty as one ton, or twenty cwt. of Newcastle small coals. The coke used for these experiments was oven burnt (somewhat stronger than gas coke), made of small Newcastle coals. More recent experiments upon gas coke in lieu of oven burnt coke have, however, scarcely altered the practical results.

The above operation of fusing glass with coke fuel was continued for several months, the consumption of coke was at the rate of about thirty chaldrons per week, and the coal about the same number of tons. Mr. Frederick Pellatt, at the Falcon Glass Works, Southwark, has recently used gas coke fuel in the proportion of twenty chaldrons of coke to one ton of coals, for above twelve months, with economy and success, and has fully corroborated previous experiments; he has also experienced collateral advantages, viz., that coke refines the metal many hours earlier than coals, is more certain in its effects, especially under unfavourable winds, that the pots or crucibles are of longer duration, with a relative saving of about 2½ per cent., and an almost entire prevention of smoke. It may be assumed, therefore, that in localities where gas coke can be purchased as cheap or cheaper by the chaldron than small coals can be by the ton, coke will be superior to coal in heating power for raising steam or for melting metal. Gas coke made from Wigan coal is of fair quality, although not so good as that from Newcastle coal,

and may be had cheap at the Liverpool, Manchester, and other gas works. Coke made from Barnsley coal is decidedly inferior, and from boghead or cannel coal scarcely better than breeze. Coke carted from the retorts freshly made is better than that which is taken out of store. Coke, if stored, should be placed under cover, and kept free from wet. Coke carted direct from the gas works for immediate consumption is much more valuable than when broken by storing or lightering, or, by being repeatedly moved, which reduces a considerable portion of the coke to breeze; the latter fills up the interstices of the coke, and impedes the draft of air or oxygen, so essential to its speedy ignition and calorific effects. Messrs. Maudslay used gas coke in air furnaces for fusing brass, but are now burning Welsh coals. A large quantity of gas coke is used in the proportion of one-third of coke to two-thirds of small coal, with great economy, and almost smokeless effect, at the extensive works belonging to the Lambeth and Southwark Water Company at Hampton, under the able superintendence of Mr. Quick, their engineer.

It seems somewhat anomalous that Newcastle or other bituminous coal, after having parted with the whole of its bituminous constituents by the process of coking, and that to the extent of one-third of its weight, should, by the combustion of the carbon or coke only, give as much calorific effect as coal with its combined powers of bitumen and carbon, whether for raising steam or for fusing metals, which not only the before-mentioned facts go to establish, but which has been lately again confirmed by the use of coke under a ten horse boiler at the Falcon Glass Works, which superseded the previous use of coal, although they were aided by Knowelden's patent machinery for spreading equal quantities of small coals in uniform supply over the surface of the furnace, kept in motion by alternate moveable bars between fixed bars, connected by a crank with the engine power, producing a sort of rotary diaphragm action, or onward impelling movement, which, with a proper admission of air, effectually prevented smoke. For some time it worked extremely well, but as coke at that time was 10s. 6d. per chaldron, while the price of small coal was 13s. per ton, it was discontinued. This invention has been recently tried by the French Government, and was reported upon in the *Times* of the 5th August last, under the head of Paris, to the effect that Knowelden's patent for France had been purchased by the municipal authorities of Paris, after a trial of fire place and bars, imported into France specially for the experiment. It has been decided upon as the cheapest in application, as well as for the economy of fuel, and unattended by the danger of explosion (as was the case with the invention which Mr. Knowelden's patent superseded), as also for completely preventing smoke. Most of the brewers of the metropolis are now great consumers of screened small coal, upon Juckes's old established endless chain principle, with economy and success, which also effectually prevents smoke.

No doubt many other good inventions, such as double furnace boilers, &c., are in use in England, but, I think, these remarks are due to Mr. Knowelden's patent, the writer having watched its operation for several months.

Mr. Williams, of Liverpool, considers the apparent anomaly before referred to, viz., carbon or coke only, doing duty as effectually as coal with its double constituents of bitumen and carbon in a compact state of adhesion, is due to, or explained by, the "expansion and fusion of the bitumen, the generation of the gas, its absorption of heat during such expansion, its combustion, the subsequent combustion of the solid carbon, and so on; for, if not managed with due attention to the wants of each, these several processes interfere with, and mar each others effect; also, that if a charge of fresh coal be thrown on a furnace already in an active state, so far from augmenting the general temperature, or giving out heat, becomes at once an absorbent of it, and that so long as any of the bituminous constituents remain to be evolved from any

atom, or division of the coal, its solid, or carbonaceous part remains black, at a comparatively low temperature, and utterly inoperative as a heating body." He further compares such loss in the process "to the consumption of fuel under retorts during the process of gas making, the entire accessible heat being absorbed and carried off by the bitumen during its expansion," and the release or evaporation of the ammonia, water, &c. Thus he solves, in a great measure, the apparent anomaly of bituminous coal giving out no more heat than is due to the combustion of its coke only.

As the value of tar, ammonia, sulphur, naphtha, and the bituminous products of coal get more commercially known, other means of separating coke from coal may probably be devised, and the waste of valuable bituminous products prevented, thus throwing into the market much greater quantities of coke than can be produced at gas works for furnace combustion.

For private use, gas coke is objected to on account of a disagreeable sulphurous smell, which, at the gas works at Liverpool, is obviated, by putting about 14lbs. of common salt to every charge of coals in the retorts, which, when distilled with the coal, is said to purify the coke, and improve the quality of the gas. A prejudice exists that coke used for fuel under steam boilers is destructive to the bottom plates. With an enlargement of fire-place for incandescent coke, while operating upon an enlarged surface of the under boiler plates, no material deterioration takes place. Mr. Innes, engineer to the Phoenix Gas Works, at Bankside, had a boiler for nine years working day and night with gas coke, after it had been used with coal in other works for seven years, making a service on the whole of sixteen years. Its form was cylindrical, 16 feet long by 3 feet diameter, with a furnace 5 feet long by 2 feet wide.

The abolition of the smoke nuisance in Manchester and other northern cities would cease to darken and discolour its churches, commercial palaces, and handsome public edifices, to say nothing of injury to curtains and furniture; Victoria-park, and the vegetation and foliage of the shrubs in the environs of great cities would be much improved.

If the gardener of the templars, on the Thames, sang the praises of the Smoke Nuisance Prevention Act, for restoring the beauty of his roses, foliage, &c., should not such benefits be extended by the same means to the smoky Peel-park of Salford, and to the manufacturing districts of the north? Shall it be said that their merchant princes are indifferent to the advantages of a purer atmosphere for the cleanliness and comfort of the working population, who have already so nobly expended millions of money in people's parks, public libraries, literary institutions, churches, chapels, &c.? Shall these manufacturers be driven into improvement by the extension of the Metropolitan Act to all the provinces, with the Home-office police to enforce its provisions?

If the Royal Commissioners appointed to determine whether the site of the National Gallery should be changed, acknowledged "that in regard to atmospheric impurities, recent legislation, which had done *so much*, and may do more to purify the metropolitan atmosphere, would probably much improve its present condition," and who reported that its present site was most advantageous, shall it be said of the magnates of Manchester, whose city recently received so powerful a stimulant in the fine arts by its magnificent Exhibition of Art Treasures, that they have no sympathies in favour of purer air and the reduction of the smoke nuisance? Is it to be said, in the words of the poet, that it is not to

"be preferred to smoke,  
To the Eclipse that metropolitan volcanoes make,  
Whose Stygian throats breathed darkness all day long."

Surely the time has arrived when humanity, art, science, and philanthropy, should combine to prevent the air in all our manufacturing districts from being longer con-

taminated with volatile, bituminous, discolouring impurities, which in most cases might be turned into profitable channels of commercial remuneration, and thus improve the health and wealth of the British nation.

#### DISCUSSION.

Mr. CHARLES WYE WILLIAMS said, although the author of the paper had done him the honour to quote *somewhat* extensively from the works which he had laid before the public on this subject, he nevertheless differed entirely from that gentleman's conclusions on several important points. Mr. Pellatt had said it was somewhat anomalous that Newcastle or other bituminous coal, after having parted with the whole of its bituminous constituents by coking, to the extent of one-third of its weight, should give as much calorific effect as coal with the combined power of bitumen and carbon. Now if the fact were so, it would be an anomaly, but it was not the fact that coke possessed superior or even equal heating properties with coal. The author of the paper had stated that he (Mr. Williams) explained away this alleged anomaly by showing the great heat that was lost in the generation of the gases. It was true he had dwelt upon the loss of heat in the generation of gas, but he did so to show that unless they turned those gases to account, they lost all the heat that was absorbed in generating them. From these and other circumstances, he thought the author had not seen the second edition of his treatise, inasmuch as on several points there was an evident misapprehension of his (Mr. Williams's) views on this subject. He had found that even the most scientific men had been often led into great errors on this question, instancing the case of Dr. Fyfe, of Edinburgh, who had expended much laborious research in order to prove that the value of coal was only in proportion to the quantity of fixed carbon that it contained. Never was there a more erroneous idea. The author of the paper had stated that Lord Palmerston's Act compelled the use of coke instead of coal.

Mr. APSLEY PELLATT begged to say the Act did not compel the use of coke, but only that there should be no smoke from the chimnies of manufactories, leaving the parties to employ what means they chose to prevent the smoke.

Mr. WILLIAMS added that in Liverpool the prosecutions under the Smoke Act were very frequent, and they were obliged to use coke or anthracite coal; they could not burn common coal in their furnaces, simply because they did not admit a sufficient quantity of air into them. A recent instance of the mistakes into which engineers sometimes fell, was afforded in the case of the boilers of the *Leviathan*. He must say they presented the greatest violations of natural and chemical laws that he had ever witnessed. He defied them to burn coal in the furnaces without great waste of fuel and enormous evolution of smoke, and they must use anthracite coal. The same remark applied to the *Great Britain* steam-ship. Each double boiler of the *Leviathan* contained 12 furnaces, and about 400,000 cubic feet of atmospheric air per hour was required for proper combustion of the gases alone; but how was the air to get into the furnaces? It really seemed as if the utmost pains had been taken to exclude the air; and to say that the air could be supplied through the fuel on the grate, was to say that a man could breathe the air which came from the lungs of another person. It was an ascertained chemical fact, that a ton of coals producing 10,000 cubic feet of gas required 100,000 cubic feet of air for thorough combustion. Prof. Daniel had even estimated it at double that quantity. Mr. Williams produced for the inspection of the meeting an apparatus for indicating the quantity of air that passed into a furnace.

Mr. FREDERIC PELLATT said, in a question of this kind facts were better than opinions. In his manufactory for many years they used small coal in the melting of glass, the consumption amounting to about 30 tons per week.

Contrary to the prejudices of himself and his workmen, he was induced to try coke. The stokers asserted that it was impossible to get sufficient flame from it to do the work. However, the experiment was made, and the result of a trial of eighteen months was that they practically got from 13 cwt. of coke the same amount of work as was obtained from 21 cwt. of coal. That was a practical fact within his own experience. With reference to the consumption of smoke, he could not say much; but he believed it depended very much upon the heat at which the air was allowed to pass into the furnace. He had lately seen a new invention for heating the air. It consisted of a double furnace door of thin sheet iron, the two being about 18 inches apart. On each side of the door were five or six shelves, and the air being introduced from below, those shelves served to prevent the too sudden rush of the air into the furnace, and the air was heated and passed into the furnace in a very hot state. There was also a double door at the back of the bridge. He believed the furnace he had described to be quite smokeless and very economical, very much upon the same principle as that adopted by Messrs. Doulton, but more easily applied to ordinary boilers.

Mr. LEE STEVENS ventured to dissent from the general conclusions arrived at by Mr. Apsley Pellatt. He wished to remind him that, in his statement that not only would 7 lbs. of gas-coke evaporate more water than 10 lbs. of coal, but that the products of gas, tar, &c., arising from the conversion of the coal into coke, would be of higher value than the original cost of the coal, he had altogether omitted to say what the expense of such conversion would be; it being evident that the contents of the retort could not be acted upon without a corresponding expenditure of fuel, labour, &c., which ought to appear on the other side of the account. As regarded the advantages of the use of coke in certain manufactures, such as glass, he had no doubt whatever, because his own information and experience enabled him to verify Mr. Pellatt's, in relation to the application of heat to melting pots, crucibles, cockles, and small reverberatory furnaces. In a few cases, also, coke might be more beneficially used for small steam boiler purposes; but, certainly, not as a rule. The heat from a coke fire, like that from anthracite coal, was a concentrated and not a diffusible heat, but for large steam boilers of all kinds, in which it was desirable to have the greatest amount of heating surface, gas-producing fuel, (and the more bituminous the coal the better,) by affording the means of enlarging and elongating the flame, must, necessarily, be the most economical and effective. Hence, he was convinced that Mr. Pellatt had come to an erroneous conclusion, from imperfect data, having measured the more universal requirements of furnace work, and particularly for steam-engines, by the experiences of his own glass-house. It should also be borne in mind that, where cast or wrought iron had to bear the concentrated heat from coke or anthracite fires—or, in a lesser degree, from that of the semi-bituminous fuel known in London as the smokeless Welsh coal—very considerably increased destruction of the metal took place. His friend Mr. Macgregor Laird thoroughly tried the use of anthracite coal in a line of steamers between this country and the African coast, but was soon compelled to abandon it, in consequence of the rapid destruction of the steam boilers. He would give, in a few words, some information he had that day obtained at the gold and silver refinery of Sir Anthony Rothschild. There he had applied his regulating air-doors to several furnaces in which the Welsh coal had hitherto been used, but which had since been supplied with a more gas (or smoke) producing fuel. Previously the shields, or fire-door guards, had to be renewed every three or four weeks. Since the alteration the new doors remained without repair for about six months. Before the change of doors and fuel, the wrought iron fire-bars were sometimes melted in a single day, and had generally to be removed every week, but now on the average they lasted a month.

In the crucible furnaces, however, coke was there, as elsewhere, most advantageously used.

Mr. BENJAMIN FOTHERGILL had made a great number of experiments in testing on locomotive engines the relative value of coal and coke for heating purposes. As far as his own experience went, he could say that, wherever contrivances were introduced to effect perfect combustion, comparing coke with coal, the saving was tantamount to one-third in favour of coal. Experiments made on the Belfast and County Down Railway had shown that whilst the cost of taking a train with a given number of carriages from one place to another, with coke as the fuel, was £1 17s. 6d., the quantity of coal required to do the same work cost only 16s. 6d. In applying fuel to locomotive as well as stationary boilers, unless they could avail themselves of the extended flame produced when perfect combustion took place, then, to some extent, the smoke would prove seriously detrimental; and when they carried the unconsumed products of combustion along the main flue, or along the sides of the boiler, the carbon collected upon the surface of the flues, and prevented the heat from acting to the extent it otherwise would do. On the contrary, where they could convert the whole of the products of combustion into flame, and then take them through the main flue and along the sides of the boiler, the results were very much in favour of coal. They ought to take into account the enormous expenditure of fuel for converting the coal into coke; and in judging of experiments such as that mentioned by Mr. Frederick Pellatt, they ought to be informed of the relative cost of the coal and the coke, adding to the latter the cost of fuel for making it. He hoped, on a future occasion, he might have the pleasure of reading a paper before the Society on the subject.

Mr. GREAVES remarked that he was burning not less than 4,000 tons of fuel per annum, and therefore need scarcely apologise for submitting some practical observations. He stated that he agreed, in the main, with the author of the Paper, but he could not go so far as Mr. Pellatt did in his opinion of the advantage of coke fuel. As he desired his observations to be of a practical nature, he would not enter into any theoretical questions, but merely state that the data he would submit were derived from fuel burnt under steam boilers, commonly known as Cornish boilers, with high-pressure steam. The working of the engines was registered daily, by means of counters recording every stroke, and the coal for every engine was weighed daily, and a strict account kept of it. The experiments extended over five years, during which the engines were working under the same load, and in all respects under similar circumstances. The total amount of fuel from which the averages were drawn, was little short of 10,000 tons, and although during the time many minor variations might have occurred, it was assumed that the length of time and largeness of quantity might be fairly considered to have brought these variations to a fair average. The experiments were commenced in 1852, some time previous to the passing of the Smoke Act, and a good average had been obtained of the efficiency of small coal, or slack, which was taken as the standard. Small coal in London was in quality of a rather superior character, being very much composed of the screenings of best coals. Taking this as a standard, the value of other fuel was given in per centage upon it, and stood as follows:—

Wood's Merthyr, advantage in efficiency by				
weight	...	...	...	23.92
Powell's Duffryn	...	...	...	20.11
Nixon's Merthyr	...	...	...	17.31
Anthracite	...	...	...	12.91
Baich-grove	...	...	...	13.85
Resolven, and others of the softer Welsh coals	...	...	...	
Llangennoch	...	...	...	5 to 10
Holywell Main	...	...	...	5 to 10
West Hartley	...	...	...	
South Penrith, and other Newcastle steam-coal	...	...	...	

Coke, as generally made by the London Gas Works:—

2,077 tons	...	...	12-98
977 "	...	...	14-52
582 "	...	...	12-36

These numbers were obtained from computations which included the efficiency of the engines as well as the boilers, and were, therefore, only comparative figures; taking the highest, however, as corresponding to 10½lbs. of water boiled off per lbs. of fuel, the other numbers would all follow in comparison. He therefore did not feel it necessary to supply the additional data for the boiler duty only; it was, however, obtained by measuring the supply continuously into each set of boilers by attaching there a meter which was continuously at work, and was registered every evening along with the engine strokes for the day. The simple efficiency of the fuel under the boiler could therefore be separated from any deranging effects due to the engine. The erection and attachment of a meter was a most useful and inexpensive precaution. An inch meter would supply 150 to 200 horse power of boilers, and need not cost more than £10. The high ratio of 1 gallon of water boiled off per pound of fuel was only to be obtained in constant day and night work; in cases when fires were drawn, banked up, or when the work was interrupted during each night, a reduction of duty occurred to the extent of from 1-6th to 1-10th; 9lbs. of water for 1lb. of fuel was a very good result when the work was intermittent, but the scale of comparative efficiency was equally applicable at that rate. The rate of burning at which the above data were obtained, was that of 2½lbs. of fuel of the better qualities per horse power per hour, 4lbs. per square foot of grate per hour, and with a draft pressure of 1-10 inch of water in the flues measured at the front of the side flues. This last test was the best practical indication of the quantity of air taken into the furnace, and was much more easily applicable than a direct machine for measuring that quantity. He had informed the Society of the comparative value of these three fuels—Welch coal, coke, and small coal. In coke itself he was not of opinion that there was any very great difference in the quality of the coke produced by the different Gas Works, provided there was no Cannel coke mixed with it. The coke from Cannel was very inferior, very heavy, and metallic, producing very foul fires, and giving great labour and trouble, and from special trial was found only to produce from  $\frac{1}{4}$  to  $\frac{2}{3}$  the duty of the best quality. The weight of coke was taken at 12 cwt. to the chaldron of 60 cubic feet, dimensions which were settled on exact weighings of large quantities; that bulk a little exceeded the statute size, but was chosen as an even figure. He was in the habit of buying coke always by measure, to avoid the unfair addition of water, the quantity of which that might be absorbed by dry coke was very large indeed, and not only created a loss by the actual weight itself, but as every pound had to be evaporated in the fire instead of in the boiler, it created to that extent a perfect waste of fuel. The limits before mentioned for the rate of combustion were 4lbs. per square foot per hour (not less), but these rates were only obtained where slow combustion was carried on. With reference to the question of smoke prevention, he would observe that it should be borne in mind that there were three things to be mixed in a furnace—coal, air, and heat; that is, that it was necessary that a certain quantity of heat should be present in the furnace in which the coal and air had to be mixed. The greater the heat the more easily would the smoke be prevented, and therefore a heavy hot fire allowed a larger quantity of air being admitted to reduce the smoke that would, without it, arise. Great difficulty occurred with slow combustion in avoiding smoke; he had himself failed in his attempts to prevent smoke from Cornish fires. It might be much reduced, perhaps to one-half, by

a large admission of air, but a fall in the duty always accompanied the result. Having more than 16 boilers, all leading to one chimney, of which nine were constantly in work together, he was under the necessity of excessive care, as the united smoke of all the fires soon exceeded parliamentary limits, when any attempt had been made to work bituminous coal. When the rate of burning came up to 10lbs. of fuel per square foot of grate per hour, with a lower rate of boiling off, or duty, it was more easy to prevent the smoke. As to the objection to sulphur in coke he did not believe it to exist. It had often been said and believed that there was more sulphur in the coke than in the coal it came from, and more sulphur in gas coke than ordinary steam coal. Judging, however, that sulphur was a nuisance to the gas-maker, he rather trusted that he would avoid it for his own sake, and that the coke was less pregnant of sulphur than steam coal generally; he had, at least, long experience to show that no damage occurred by it to boilers, and there was a slight diminution in the destruction of fire-bars; this experience resulted in the use of 650 horse-power of engines and boilers in the establishment under his direction. As to the price of the fuels, the average price of small coal might be taken at 11s. 6d. per ton, the lowest price had been 10s., and the highest 12s. 6d. when buying large quantities; the price of coke was not under 19s., the cost in the trade books for eight half-years standing—20s. 7d., 21s. 4d., 21s. 4d., 19s. 3d., 21s., 20s. 8d., 19s. 5d., 21s. 5d. per ton, after all allowance for ingrain and deficiency. Considerable loss from drying also occurred in all fuel, if kept long in covered stores. By this the above prices per ton had been made higher than the market price of coke at the same time, and these corrections were of essential value; fuel, however, could not be too dry for duty. Mr. Greaves hoped those facts would be acceptable to the Society, being his experience in London fuel, burnt in that ordinary way which he imagined to be the object of the author of the paper to have discussed. The calculations had been made with great care, and were reliable data as averages derived from large quantities. The efficiency of the coke and other fuels, as far as they showed an advantage over slack, must be taken as in abatement of the excess in price, leaving the ton of small coal and the ton of coke, in useful effect when unmixed, as eleven shillings and eighteen shillings, the former with smoke, the latter without. The cost of smoke prevention was therefore seven shillings per ton, on all the fuel so consumed as to comply with the Metropolitan Smoke Nuisance Abatement Act of 1853.

Mr. HYDE CLAKE said, in an establishment abroad with which he was connected, the consumption of coals amounted to about 50,000 tons a-year, at a cost of £2 per ton, including freight. Economy of fuel was therefore, in such a case, a question of the greatest importance. Coke had been tried in the same establishment, but without success. There was a fact which ought not to be lost sight of in this discussion, namely, that, by a proper attention to the system of fuelling, a saving of as much as 10 per cent. could be effected. He thought, in a question of this kind, where everything depended upon the conditions under which the experiments were made, they had not sufficient details at present to enable them to arrive at any definite results. In the instance mentioned by Mr. Frederick Pellatt, it was probably a case of fresh coke compared with stale and badly stored coal.

Mr. WENHAM begged to describe a simple and perfectly effective method of consuming smoke, discovered by Mr. Hugh Mair, of Glasgow. It was not the subject of a patent and did not interfere with existing patents, therefore anyone was at liberty to make use of it. It was applied to a short cylindrical boiler having an interior flue containing the fire place. On both sides of the inner flue there were a number of tubes, below the water-level, for bringing the hot-air and flame back



again to the chimney which was placed in front. At the further end of the boiler there was a double iron casing, or smoke-box, which covered the end of the fire-flue and return-tubes. Mr. Mair, finding that this double casing became inconveniently hot, drilled a number of small holes through both the plates, with the view of admitting a current of cold air between them for the purpose of keeping them cool. The immediate result was that it became a most perfect smoke-consuming apparatus. The volume of smoke coming from the fire was thus directly met by numerous jets of hot air passing through the end casing, the opposing currents causing an intimate mixture, and a complete combustion of the suspended carbonaceous matter. So perfectly was this effected by this arrangement, that the chimney could not be made to smoke, however bad the fuel (coal) or carelessly the fire might be stoked.

Mr. BLASHFIELD expressed a wish, looking at the great importance of the question, to hear some further explanation of the plan of furnace adopted by Messrs. Doulton, at their works in Lambeth.

Mr. H. DOULTON remarked that the present discussion had shown that the relative value of coal and coke depended upon the circumstances under which they were used. He was sorry to hear some little discredit thrown upon scientific experiments, and he felt much indebted to Mr. Wye Williams for the valuable light he had thrown upon this subject. He thought they could only arrive at reliable results by following the careful researches of scientific men. With regard to the relative values of coal and coke, as to their heating qualities he could state that during the last four years he used a considerable quantity of coke in his pottery works, and practically he had found it very advantageous, although he agreed with Mr. Williams, that if they could employ the whole of the bituminous products, coal would be immensely superior to coke. But there were practical difficulties in getting the requisite quantity of air at the right time and in the right place. In fact, in a large body of coal they could not get the air to circulate, and an admixture of coke in such cases was an advantage. In building up a fire gradually, coke might be used with advantage in causing the air to circulate through the fuel and promoting the perfect combustion of the whole mass. He would add that the carrying power of coke was by no means equal to that of coal, and the success of the experiments already made depended upon the length of the boilers. He did not think coke could be used in very large proportions by potters, for want of carrying power, but a small quantity might be used with advantage.

The CHAIRMAN, in proposing the thanks of the meeting to Mr. Pellatt for his Paper, expressed a hope that this subject would be taken up at a future time by some of the gentlemen he saw present, who were so well qualified to treat it. The theory of the matter they were all acquainted with; what they wanted was the results of practical experience.

A vote of thanks was then passed to Mr. Apsley Pellatt.

The Secretary announced that on Wednesday evening next, the 9th inst., a Paper, by Mr. S. Sidney, "On the Progress made of late years in the Manufacture of Agricultural Machines and Implements," would be read.

## THE SEWAGE OF LONDON.

By HENRY ALLNETT.

The drainage of the metropolis for the removal of the sewage is so gigantic an undertaking, and involves so great an outlay, that we should not regret the delay that is occurring before a final scheme can be agreed on, as, from the various suggestions that are continually being

made, we may hope at last to arrive at the best method of carrying it out.

As the subject is still under discussion, I beg to offer the following observations:—First, one or two open main drains or channels, of some miles in length, passing through a populous district, must be objectionable; neither is it considered that the mere covering of these long main drains will remove all objections, for poisonous vapour will still be generated from the immense extent of surface, and it will ooze out at all times, especially in warm weather, and during periods when repairs are in progress, and also at the reservoirs. Secondly, the fall (if I understand correctly) of six inches to the mile, for such a thick turbid stream as sewage, I apprehend cannot be considered satisfactory; indeed, from the low situation of the City, and the almost dead level of the river, probably a greater fall cannot be obtained on the margin of the Thames, except by the construction of extraordinary works in a measure regardless of expense. Supposing recourse is had to pumping up the sewage to a higher level, for the purpose of obtaining a better fall, how is it intended to deal with a fall of rain equal to that of the 22nd Oct.? The Registrar-General reports that one-tenth of the total yearly average rain fall for London fell on that day, viz.,  $2\frac{1}{2}$  inches—being, for the area of London, about 20 millions of tons, or 84 millions of hogheads. The returns of the Registrar-General show that the amount of rain-fall on this 22nd Oct. equalled the total fall of rain in the month of January last, and nearly that of August last.

A short time ago I visited the sewage works at Watford. No town appears better situated for successful drainage, as it consists of only one street, about a mile in length, with an admirable fall to the works, which are not more than a quarter of a mile distant from the lower parts of the town. But even at Watford, with these advantages of ample fall and short distance, &c., great objections have been urged against the works, and I understood actions at law had been threatened for the abatement of the nuisance.

As the main sewer to the pumping engine is covered, we might feel surprised that annoyance could arise, but I observed an uncovered spot where the odour evidently escaped, which was a small space where a grating was fixed for the detention and removal of paper, rags, skins, hair, &c., obstructions that would soon interfere with and injure the machinery. If, with works so advantageously situated as at Watford, complaints have been expressed, what an outcry might be anticipated with works of such a magnitude and nature as those proposed in the scheme for the drainage of London; therefore, I fear the plan of removing the sewage by one or two main drains of some miles in length, will prove unsatisfactory. And supposing we allow that a channel of so many feet in width will be sufficiently large at the present time, it might not answer a hundred years hence; and where and at what period are we to stop or divide the flow of sewage, and construct an additional drain to convey it to the river or sea, and also make every provision for heavy rain falls?

At Watford they are unable to cope with a heavy fall of rain. When such takes place, I was informed, they shut off the flow of water to the tanks (after about the first half-hour), and suffer it to be discharged into an open ditch, which conveys this overflow to the neighbouring river. This may be also a source of annoyance to the locality, and unquestionably a covered drain should be substituted for the open ditch. No reasonable number of tanks or reservoirs would contain the water flowing through the sewers when heavy rains occur; and if such were possible, the liquid would be of little or no value for agricultural purposes.

When the population of London is increasing so rapidly, and food is required, is it not most unwise to throw into the river that which tends to promote the growth of all vegetables? We might, with equal reason,



cast into the Thames the waggon-loads of manure we daily observe leaving the City for the market gardens.

The sewage of Watford falls by its own gravity into reservoirs, and is then pumped up by steam power, and cast over fields of Italian rye grass, which consequently is cut six or seven times a-year; indeed there appears scarcely a limit to its growth, provided there is warm weather after the application of the sewage.

I submit we should hesitate no longer, but apply our energies not to seek a method of casting the sewage into the sea, but of utilising it: and if the drainage of the metropolis is so complicated and difficult a problem to solve, as to stagger the most clever minds amongst us, why not make an experiment in one district, with the view of using the sewage on the land.

Would it not be possible to drain a district into covered reservoirs, built near to or where a communication could be made with an existing line of railway; the sewage could then be drawn off, or made to flow from the reservoirs (not pumped) into closed railway trucks. Several of these might be filled at the same time; and these trucks could be brought from the reservoirs up an incline to the level of the railway by steam power, and then conveyed any distance into the country.

The system of precipitating the solid parts of the sewage is not recommended, for the manufacture of solid manure occupies too much time, and the expense of so doing, together with the nuisance it might create in the neighbourhood, renders such a process out of the question, at least as applicable to London. It is also asserted by some parties that much of the valuable fertilising properties of the sewage would be left behind in the water, which would be cast away, and so be lost by the agriculturist. Again, it must be recollected that the farmer does not require manure in a dry state, and although receiving the sewage, as here proposed, just as it issues from the drains (without being strained through a grating) involves greater expense in carriage, yet we save the cost of reducing the sewage to a dry state. And above and beyond all considerations, the system I suggest is the quickest way of getting rid of such an unpleasant article.

The closed trucks to hold the sewage should be filled without exposing the sewage to the air, and when filled, the trucks could be conveyed by railway, *by night*, and left at the various stations for, or at, the farms requiring the sewage. There would be no difficulty in having a short single line diverging from the main line\* on a raised stage of timber, so that the trucks could be emptied without delay (by valves opening in the bottom of the truck) into the middle of a heap of earth prepared for the reception of the sewage, which would filtrate through or be absorbed by it, and form a rich compost; and this could without difficulty be carted to any part of the farm; or the trucks could discharge their contents into tanks formed immediately under the railway stage, so that the farmer could irrigate his fields, or make use of the sewage in any other way he considered best.

This arrangement for discharging the trucks whilst standing on the railroad, *above the depot*, is similar to the plan adopted for unloading coal at many stations.

It will be observed that, adopting the system I have sketched out, there is no necessity for pumping the sewage either into or out of the reservoirs or the trucks, and a large item of expense is thus avoided.

Now, as respects a heavy fall of rain:—First, it could be arranged that all the surface water from rain should be conveyed direct to the river;—this is objectionable, as the sewers may require flushing; but still, after a certain time the current of water from this source could be made to deviate from the reservoirs and flow into the river;—it cannot be supposed that by the adoption of any scheme for the drainage of London, *the Thames will be relieved from every impurity*. Secondly, if the depth of the reservoirs and other circumstances are such as to

render it necessary for flushing, that the rain water must flow the whole course of the sewers down to the reservoirs, then a system of pumping could be adopted to raise *this water only*, and discharge it into the river,—the engine required to draw up the loaded trucks could be employed in *occasional pumping*. It is submitted that after a certain interval for flushing the sewers, the rain water should always be run into the Thames, and probably in most cases the existing sewers would answer this purpose.

It appears, from the return of the Registrar-General, that 22 inches of rain have fallen during the past twelve months, viz., from November, 1856, to October, 1857, inclusive; and that this amount fell on 130 days only, out of which 12·33 inches fell on 20 days, and the remainder 9·67 inches fell on 110 days,—viz., 52 days from 0·01 to 0·05—21 days from 0·06 to 0·10—19 days from 0·11 to 0·15—10 days from 0·16 to 0·20—and 8 days from 0·21 to 0·25 of an inch; furthermore, that the average fall on these 110 days was 0·09 of an inch.\*

Now to apply these results to the subject we have in hand, supposing that rain-water does not materially increase the flow of sewage, excepting when the fall exceeds the tenth of an inch, then we find that in 57 days ( $19 + 10 + 8 + 20 = 57$ ) we may be compelled to allow a discharge of rain-water into the river Thames for a few hours each day.

I may be allowed to add that a locality between Kensington and Hammersmith, near the West London Railway, appears well calculated for the experiment I have suggested; and it is probable the chief work to be done in the way of sewerage would be the formation of intercepting sewers eastward to Kensington, Brompton, Knightsbridge, and Pimlico, and westward to Fulham, Hammersmith, &c. In the construction of these sewers, measures could be adopted, by means of sluices, to shut off the rain fall at any time, and cause it to flow into the Thames by its old course.

In conclusion, I have only to repeat, that open or closed main drains for the discharge of the sewage into the river as proposed in the scheme for the drainage of London, should not be adopted; and, further, that manure of every kind is too valuable an article to be wasted, therefore, every endeavour should be made to embody a plan for utilising the sewage; no insurmountable difficulty exists that I am aware of, why an experiment should not be made in one district; and when making this proposition, I am not insisting on the sale of sewage as a remunerative speculation,—but we all agree it must be removed, and if it is valuable on the land, and we can dispose of it at any price, it must be far better than casting it into the Thames a few miles below London-bridge; after all the labour and very great outlay, we shall in that case only remove the nuisance a *degree further from London*, and assuredly shall injure the atmosphere of another locality.

I believe it will be found that the application of the plan I have proposed would be met by the construction of nine sewage works,—six situated to the north of the river Thames, and three to the south of it.

It may be urged, that the removal of sewage in closed trucks by railway would be perfectly impossible, and I admit that the work to be done is indeed immense, but I believe, not impossible if London were divided into districts, and the rain fall allowed to run into the

\* On referring to the same returns, I find that on only three days in the year 1855 rain fell 1·00 inch, viz., 11th July 1·42, 26th July 1·15, and 20th October 1·06 inches. In 1856, only one day the rain fall amounted to 1·00 inch, that is on the 26th June; we see from this, that it was a most extraordinary fall of rain for Greenwich to amount to 2·57 inches; nevertheless, such a fall of rain may occur again, and every allowance should be made for double this fall if we entertain the idea of pumping up the sewage to a higher level, as two days of such a fall of rain may follow the one after the other.

\* This could not be attempted in a cutting.

Thames; we know well, that if the many thousands of people who daily visit the city could only approach it at one point, scarcely any means could be adopted to accommodate them,—it is by the division of labour that great works are accomplished. London is not supplied with gas by one company, neither is there but one water-works; and I cannot avoid saying, with due deference to the opinions of others, that an attempt to draw of the sewage of London and cast it into the Thames (and that river subject to the ebb and flow of the tide) by one or two outlets only, will be more likely to fail than dividing London into districts, and dealing with the sewage as I have endeavoured to point out.

49A, Lincoln's-inn-fields, 7th November, 1857.

P.S.—I wish to remark that I had not seen the report and appendix of the Metropolitan Drainage when the above matter was in type, and it is only on this day that I have had the pleasure of looking over the report and appendix; had I seen it earlier, perhaps I should not have ventured to put forth my views on the subject. I am, however, glad to find that so many other gentlemen advocate the division of London into districts, that the fall of rain should go into the river, and that the sewage should be utilised,—at the same time I do not see that any reference is made to the possibility of removing the sewage as I have proposed. The rain water does not poison the river.—12th November.

#### FAN BLAST.

Mr. C. Wye Williams, in describing the mode he has adopted for many years in ascertaining the amount of draught obtained and of air actually brought into action in the furnace, says:—"This is a point of paramount importance in all inquiries touching the effecting perfect combustion. Engineers take no small pains in measuring the quantity of *coal* used, in given times, in a furnace, yet altogether omit that which is equally essential, and equally susceptible of measurement—namely, the quantity of air supplied. Equally inattentive are they to the providing the relative quantities required by the *coke* portion of the coal, and the *gas* generated in the chambers of the furnace above the charges of coal. This unwarranted and unaccountable omission can only be equalled by that most absurd of all inferences, that the due supply of air for the combustion of those gases may be received from the ash-pit, and through the bars and the solid fuel on them, at a time when those bars are choked up with clinkers. For what could be said in justification of a chemist about to perform a difficult operation, were he to be particular as to the quantity employed of one only of the ingredients necessary for the success of his process, and at the same time to be wholly indifferent to that of the other ingredients, although precise quantities of each were equally necessary? Perhaps one cause of this omission may have been the apparent difficulty of measuring or ascertaining the quantities introduced. This difficulty required first to be overcome before we were in a position to judge of the means for supplying the great volume of air which nature absolutely demands, and the separate quantities required for the *solid* and *volatile* portions of the fuel employed.

"The *absolute* quantity, in volume, of air put in motion by the action of a fan, either in exhausting or propelling, cannot be estimated, since we cannot force or measure the air passing through it as we do through a cylinder of ascertained contents. Air cannot be compressed by the action of a fan without a large loss by its friction. The quantity will therefore vary with each change of the indraught or exit orifices and the amount of friction to which it may be subjected.

"By the mode I have adopted, however, we come so near the absolute quantity, and obtain such correct *relative* quantities, that practically it satisfies all that may be required."

Mr. Williams's air meter consists of an ordinary cir-

cular vane, through which the air has to pass during the operation, producing motion like that of a windmill, increasing in rapidity in proportion to the strength of the current passing through it. This circular motion of the vane is transferred to a series of dials, similar to those of the ordinary domestic gas meter. The number of revolutions of the vane are then recorded in units, tens, hundreds, &c., up to 100,000, thus enabling an experiment to be continued during above 100 minutes. This vane is eighteen inches in diameter, and the inventor having ascertained, by a measured cylinder, after a due adjustment of the leaves, that the quantity passed during a given number of revolutions was equal to one cubic foot for each revolution, has taken that as a sufficiently reliable datum for calculating quantities. The number given by the index dials, then, will represent the number of cubic feet that have *entered* a furnace or been *drawn out*, as the case may be, or escaping by the chimney, under the different circumstances of high or low temperature, with partial or complete combustion.

Mr. Williams adds:—"The vane is hung with such delicacy and is so easily set in motion that the loss by friction of the machine need scarcely be taken into account.

"Among the applications of this meter one may here be mentioned, as it enables us to estimate the absolute and relative value of the draught produced by jets of air or steam when thrown into a chimney for the purpose of increasing the draught. By this means I have been enabled to correct numerous practical errors as to the best mode of economising the steam in the use of the jet under various pressures."

#### HORTICULTURAL SOCIETY OF LONDON.

An important address to all lovers of horticulture has been lately issued by this Society, for the purpose of opening new channels of communication with every part of the United Kingdom. The address, which is signed by the Duke of Devonshire, the Bishop of Winchester, and all the other members of the Council, and also by Lords Ilchester and Digby, Sir Charles Lemon, Sir Philip Egerton, Sir Thomas Acland, Sir John Ramsden, Sir William Middleton, Sir Walter Trevelyan, Mr. Lawrence Sullivan, Mr. Fox Strangways, Sir Joseph Paxton, Professor Lindley, Mr. Sheriff Mechi, and other Fellows, shows that in the course of 53 years the Society, by its importations and distributions of rare plants and seeds from all countries, by its publications, by its exhibitions of plants and fruits in London and at Chiswick, by giving prizes (alone amounting to above £20,000) to gardeners for conspicuous merit, and by its continued investigation of the qualities of new esculents and fruits, has so changed the whole aspect of English horticulture, that it is now as unusual to see even a badly grown plant as it formerly was to see a good one. The document then proceeds to show that the Society has also expended considerably more than £40,000 upon an experimental garden at Chiswick, which is the only public establishment in the kingdom especially devoted to practical horticulture, and is now maintained for the purpose of showing how high cultivation may be carried out with economy, of bringing to the knowledge of the public whatever is most important in fruits, esculent plants, and objects of decoration, and of exhibiting (in use when practicable) the principal implements employed in gardening. It has been through this establishment that a very large proportion of the most beautiful plants, hardy and half-hardy, which have been added to our gardens since 1816 was originally introduced, and it is felt that with an increased income consequent on an increased number of Fellows, new countries might be still explored with undiminished advantage. The Society therefore earnestly invites the co-operation of all lovers of gardening in the United Kingdoms by greatly diminishing the cost of fellowship, and infusing fresh activity into every department. The pub-

lic has already expressed its approval of these measures by adding no fewer than 197 to the number of Fellows since the 23rd September, 1856, in addition to which a sum of considerably more than £3,000 has been recently subscribed by Fellows and their friends for the purpose of enabling the Society to enter upon a new course of undiminished vigour. The long existence of the Society has rendered this the more desirable because there is now a serious diminution in the number of its supporters, owing to deaths alone; it appearing that it has thus lost as many as 322 in 10 years. The circular is accompanied by a detailed description of the plans of the Society for the ensuing season. It is stated that the country is responding to this appeal with great spirit.

#### SOUTH KENSINGTON MUSEUM.

During the week ending 28th November, 1857, the visitors have been as follows:—On Monday, Tuesday, and Saturday (free days), 2,125; on Monday and Tuesday (free evenings), 4,364. On the three students' days (admission to the public 6d.), 316. One students' evening, Wednesday, 129. Total, 6,934.

### Home Correspondence.

#### MAGNESIAN AND OTHER SALTS.

SIR,—Referring to the conversation which I had with you, on the subject of the six salts, which are resultants of my patent processes, (sealed 14 January last) to promote the sanitary and agricultural improvements therein specified, I now beg leave to hand you herewith specimens of these crystals, and to add a short explanation of their nature and uses, which you kindly offered to lay upon the Society's table at its first meeting, along with these crystals.

It would have been more satisfactory to me to have read a paper before the Society, and to have answered any questions which the scientific and medical members of the Society might have put. But this cannot be accomplished at present.

The first series of crystals laid on the table is a double salt.

1. Phosphate of ammonia and magnesia, well adapted for scrofulous diseases and softness of the bones.

2. The second specimen of beautiful crystals, is also a double salt. A sulphate of magnesia and ammonia.

3. The third series of crystals is a double chlorate of magnesia and ammonia.

4. The fourth specimen of very minute crystals is rather a precipitate, and is a triple salt not hitherto used for health or husbandry, nor produced by art for these objects until now. It is sparingly evolved by nature in urinary and other secretions, and is composed of equal parts of phosphate of magnesia and phosphate of ammonia, both well suited, when thus combined, to restore strength to bones and tissues, and to afford phosphoric acid and ammonia to crops, in a far more economical and durable manner than can result from the too soluble superphosphate of lime, or the sulphate of ammonia now used, which, in wet soils, are carried off by floods. Three tons of rain water dissolve one ton of either manure in the single state, as now applied to crops.

These double salts, however, are ten times less soluble, and, of course, ten times more permanent.

This triple phosphate is still more durable in lands than even the double phosphates; it is slowly dissolved by common salt or other muriates, and gradually gives out its nourishing elements as wanted by the plants. It is the white sand of Dr. Woollaston.

The fifth salt is a double one, namely, phosphate of soda and magnesia.

The sixth double salt is the phosphate of potassa and ammonia.

I now come to submit a brief account of the principle agents and *modus operandi* for generating the gases and their effects as motive powers, and as generators of the salts before you.

The compression of liquids by a gas pushing them up by the tension of a new atmosphere, self-injected, and driving up water to any useful elevation without steam-engines, pistons, or friction, may seem a costly operation. But the value of supplying good water to towns and rich liquid manures to farms—of generating these crystals containing all great manuring elements—of impregnating drainage with carbonic acid, and of supplying a force to scatter it over soils,—all these advantages more than repay the first cost of the raw materials used, and sometimes leave new resulting products free of expense.

The materials affording this self-acting propulsion are plentiful and cheap. When mixed in sewage they abate offensive smells and obnoxious miasms, and displace or dilute infectious airs in crowded localities.

Carbonic acid gas is here liberated from dolomite, either by mineral acids or by calcination in retorts with other carbonates. The gas is carried along with vapour, superimposing such a tense elastic pressure on water as to force up many hundred tons of sewage per day, with grit or silt, which do not pass through valves or locks by pumping. One square yard of dolomite or marble yields 16,000 cubic feet of fixed air, which, at the moment of its expulsion from red hot retorts, expands and displaces above 36,000 cubic feet of water, equal to about 1,000 tons of drainage.

One ton of dry bones liberates 300 cubic feet of fixed air which is now lost by super-phosphate makers, but by my patent manipulations, it is driven into the farmers' tanks to force up its contents imbued with fixed air, which is the natural food of plants. Another result from bones was hitherto lost, namely, the ammonia; but by my plan, ammoniates and phosphates are produced sufficient to unite with the excess of bicarbonate of magnesia, which arrests them all, and converts them into these double and triple salts, which are thus saved by this agent from melting away into subsoils and rivers.

An elastic compression results also from the evolution at their nascent temperature of ammonia, hydrochloric and sulphurous acid gases; separately generated and self-injected, they produce with animal drainage or exuviae the four salts presented to the Society.

As the sources of carbonic acid are boundless, so also are its agricultural benefits. It dissolves bones and limestone in soils, arrests and fixes ammonia, melts magnesian limestone, and forms the bicarbonate of that earth in a fluid state which I first produced and applied efficiently as a medicinal preparation in 1808.

Bicarbonate of magnesia in excess is now acknowledged to be the best deodoriser of bad breath and offensive emanations.

Sulphurous acid gas is another agent in our works, and a powerful disinfecting one. It was so used against pestilence in the Grecian camps at Troy, where Homer relates that they diffused this gas by burning sulphur in iron pans. It is now cheaply made by burning pyrites.

Hydro-chloric acid gas is also a disinfectant. It is produced from pyrites with common salt. The soda cake left in the retorts pays first cost, and is a salt valuable for soils.

Ammonia can be abundantly obtained from gas works, or by calcining coal dust and animal exuviae, thus affording a light elastic gas, which, like the others, if driven over liquids at the temperature of its evolution from the retorts, propels such liquids to any required place or service.

I am, &c.,

JAMES MURRAY.

## MEETINGS FOR THE ENSUING WEEK.

- MON. Royal Inst., 2. General Monthly Meeting.  
Entomological, 8.
- TUES. Syro-Egyptian, 7½. I. Exhibition of Egyptian Antiquities by Sir Charles Nicholson. II. Mr. Samuel Sharpe, "On the Inscriptions in the Jebel Mokhatab—the mountain with writing."  
Civil Engineers, 8. Mr. T. Sopwith, M. Inst. C.E., "Account of the Nile Ferry, at Kape Azayat, Egypt."  
Med. and Chirurg., 7½.
- WED. Zoological, 9.  
Literary Fund, 3.  
Royal Soc. Lit., 4½.  
Society of Arts, 8. Mr. S. Sidney, "On the Progress made of late years in the Manufacture of Agricultural Machines and Implements."  
Graphic, 8.  
Microscopical, 8.  
Archæological Ass., 8½.
- THURS. Royal Society Club, 6.  
Antiquaries, 8.  
Royal, 8½.
- FRI. Astronomical, 8.
- SAT. Medical, 8.

## PATENT LAW AMENDMENT ACT.

APPLICATIONS FOR PATENTS AND PROTECTION ALLOWED.

[From Gazette, November 27.]

- Dated 27th July, 1857.*
2044. Frederick Bonaparte Anderson, 56, High-street, Gravesend, Kent—A mechanical slow match for submarine or other mining operations.
- Dated 15th August, 1857.*
2174. George Tomlinson Bousfield, Loughborough-park, Brixton—Improvements in the preparation of dough for bread, pastry, cake, and other farinaceous articles of food. (A communication.)
- Dated 20th October, 1857.*
2634. Charles Tooth and William Watkin Wynne, Burton-on-Trent—An improved refrigerator or apparatus for cooling or att-tempering liquids.
- Dated 23rd October, 1857.*
2704. William Henry Hine Akerman, Bridgewater—Improvements in organs and similar musical instruments.
- Dated 26th October, 1857.*
2712. Isaac Jones, St. Helen's, Lancashire—Improvements in the manufacture of sheet glass.
2714. John Horrocks, Manchester—Improvements in winding machines, and in the bobbins employed therein, and also improvements in shuttles for weaving with such bobbins.
2716. James Ferrabee, Phoenix Iron Works, and Charles Whitmore, Stroud—Improvements applicable to machinery for carding, scribbling, and condensing wool and other fibrous substances.
- Dated 27th October, 1857.*
2718. William Clarke, Laybourne-road, Camden-town—Improved means of connecting and working breaks for railway carriages.
2723. Thomas Mottram, Rockingham-street, Sheffield—Improvements in knife handles.
2722. Robert Alexander Margetson, Norwich—Improved means of communicating between the guard and driver on railways.
2724. Robert Urie, Paisley, and William Sutherland, Penelope Works, Greenock—Improvements in the manufacture of knitted and web-netted warp fabrics.
- Dated 28th October, 1857.*
2726. Colonel Henry John Daniell, Donington-park, Derby—Improvements in communicating by signals between the pilot and steersman, and between other parts of vessels by means of dial apparatuses.
2728. Johan Ernst Fridrich Luedeko, Birmingham—A new or improved motive power engine.
2730. Pierre Adolphe Melchior Maury, Paris—Improvements in cutting the pile of velvets and other pile fabrics.
2732. Aimé Bourgeois, 457, New Oxford-street—An improvement in preparing liquor for tanning hides and skins. (Partly a communication.)
2734. Joseph Sloper, Oxford street—Improved means of, and apparatus for, obtaining motive power for propelling ships or driving machinery.
2736. William Clark, 53, Chancery-lane—Improvements in the manufacture of murexide. (A communication.)
2738. William Edward Newton, 66, Chancery-lane—Improvements in the manufacture of sewing silk, twist, and different kinds of thread. (A communication.)
2740. John Child, Loveday-street, and Joseph Child, Howard-street, Birmingham—A double-barrelled gun, with an elevated rifled tubular rib.

2742. John Fraser, Glasgow—Improvements in the manufacture of saltpetre.
2744. William Greening, Lower Edmonton—Improvements in enamelling and ornamenting metals and other surfaces.
- Dated 29th October, 1857.*
2746. Daniel de la Cherois Gourley, Wilton-house, Regent's-park—Improvements in ambulance carriages.
2748. Thomas Cook, Old Kent-road—Improvements in machinery for cutting, framing, and packing lucifer and other like wood matches.
2750. William Padgett, Poole—The manufacture of earthenware pipes for drains and sewers.
2752. Ephraim Smith, Carlisle-street—An improved safety hook or fastening, particularly applicable to securing watch chains and watches to waistcoats and other garments.
- Dated 30th October, 1857.*
2754. John Evans, Lower-road, Islington—Certain improvements in the method or methods of affixing or securing patterns and designs upon rollers and blocks used for imprinting on paper and other substances.
2756. Henry Charlesworth and William Chapman, Huddersfield—Improvements in machinery or apparatus for preparing woollen or other fibrous substances to be spun.
2758. William Shields, Salford—Improvements in machinery or apparatus for etching, engraving, and cutting cylinders and other surfaces, to be used in printing and embossing.
2760. Joseph Davy and William Bentley, Bradford, Yorkshire—Certain improvements in looms for weaving.
2762. Thomas Symes Frideaux, 32, Charing-cross—Improvements in apparatus for regulating the supply of air furnaces.
2764. Malcolm Stodart, 1, Golden-square—An improvement in the construction of the sound boards of pianofortes.
- Dated 31st October, 1857.*
2766. Henry Jean Viault and Jules Viault, Paris—An apparatus or mechanism for making signals on railways, and preventing collisions on the same.
2768. Thomas Lowe, Birmingham—A new or improved method of feeding screws, blanks, shanks, pins, and other such like articles, to turning, nicking, and worming lathes or machines.
2770. Leon de Landfort, Higher Broughton, near Manchester—An apparatus for protecting the contents of pockets of wearing apparel from theft and loss.
2774. Peter Gabbittas, Worksop, Nottingham—Improvements in washing machines.
2776. Joseph Fry, Watling-street—An improvement in cementing fabrics when india rubber is employed.
2778. James Lee Norton, Bow, Middlesex, and Edwin Wilkinson, Leeds—An improvement in extracting oil and grease from wood previous to its being manufactured into yarn or fabrics, and also when in the state of yarn or fabrics, and in scouring or cleansing such wool, yarn, or fabrics.

## WEEKLY LIST OF PATENTS SEALED.

- November 27th.*
1505. Milivolt Petrovitch.  
1526. Edouard Alexandre.  
1527. Moses Clark, Henry Oldfield, and William Salmon.  
1539. Frank Perks Fellows.  
1540. William Henry Walenn.  
1573. William Miller.  
1589. Edmund Knowles Muspratt and Balthasar Wilhelm Gerland.  
1624. Joseph Sharp Bailey.  
1652. Charles d'Ambly.  
1660. Robert Mushet.  
1696. Gustave Margfoyr.  
1711. James Champion.  
1763. Henry Genhart.  
1991. William Cliff.  
2245. George Wirgman Hemming.  
2430. Thomas Webster.
- December 1st.*
1553. Newton Bentley and John Alcock.
- November 27th.*
1569. Edmond Roy.  
1577. Thomas Latham Boote and Richard Boote.  
1592. Hiram Powers.  
1603. Edgar Brooks.  
1650. Benjamin Noakes and Frederic John Wood.  
1655. Eugène Barsanti and Felix Matteucci.  
1665. Alfred Vincent Newton.  
1671. William Edward Newton.  
1794. Robert Hattersley.  
1825. Thomas Hardcastle.  
1832. Thomas Brewer.  
1875. John Allison.  
2181. Richard Talbot and Benjamin Crossdale.  
2290. Thomas Bradford.  
2410. John Smith Barden, Aaron Watkins Rockwood, H. Hinkley, and D. Franklin Child.  
2449. John Absterdam.

## PATENTS ON WHICH THE STAMP DUTY OF £50 HAS BEEN PAID.

- November 23rd.*
2485. James Hartley.  
2491. Richard Roberts.  
2512. Sydney Smith.  
2585. John Thom.
- November 24th.*
2513. John Moore Hyde.
- November 25th.*
2494. Walter Blundell.  
2525. Joseph Whitworth.
- November 26th.*
2519. John Mason and Leonard Kaberry.
- November 27th.*
2503. Thomas Restell.  
2510. George Gowlard.  
2521. John Sands.  
2523. Frederic Le Mesurier.
- November 28th.*
2528. Julian Bernard.

## WEEKLY LIST OF DESIGNS FOR ARTICLES OF UTILITY REGISTERED.

No. in the Register.	Date of Registration.	Title.	Proprietors' Name.	Address.
4334	Nov. 26.	A Lever and Cutter for Shot Pouch Top	James Dixon and Sons .....	Sheffield.